

The Robina residential archipelago: Its current and future sustainability

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Research Project

The Robina Residential Archipelago: Its current and future sustainability

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Research project: SDUP71-400 083

A research project submitted in partial fulfillment of the requirements of Bond
University for the degree of Master of Urban Planning

Abstract

This study examined the nature of the urban connectivity and evaluated the long-term sustainability of a specific area of the suburb of Robina on the Gold Coast, Queensland, Australia. Additionally, the challenges, impacts, and benefits of the solutions proposed in this study were considered. In order to analyse the urban connectivity of Robina Woods, walkability was seen as the most critical measure. Ten homes were selected, the local amenities identified and the Green, Blue, Grey, Planned and Social barriers to connectivity mapped out.

Maps were used to trace the distances and walking routes from the selected residences to each of the amenities. A walking speed was nominated in consideration of the average age of residents, climate, terrain and slope of the area. Using this information Ped Shed Patterns were drawn and a Road Deviation Index calculated. The most significant findings indicated a significant disruption to the urban connectivity of Robina Woods to its southern and western boundaries, creating a car dependant urban design that isolates the infirm, young, and elderly despite Robina Woods being in the geographical centre of the sixth largest city in Australia. Walkability is severely restricted by the design and spatial layout of the street patterns. The lack of destinations and community facilities in a community of over three thousand people suggest a high level of social isolation for those without access to a car.

The efficiency of the road network is seen as very poor, with an inefficient and problematic hierarchical road structure. The extra cost of running a vehicle in the suburb affects the individual and the environment. The urban connectivity to the neighbouring suburbs is poor by all modes of transport especially to Varsity Lakes. There would be multiple challenges to face if any solutions for connectivity are pursued; however the physical and mental health costs, loss of social capital, and changing demographic profile are such important factors that the issue cannot simply be ignored.

Acknowledgements

I would like to acknowledge the contribution of Dr Danny O'Hare, Dr Bhishna Bajracharya, Dr Ned Wales and Ben O'Callaghan for their insightful comments on urban design and the importance of sustainable development and the involvement of the community in achieving that development during my course at Bond University. I would also like to thank my wife Janet Cartlidge for her support and proof reading contribution.

Statement of Original Authorship

This work has not been previously submitted for a degree or diploma at any higher education institution. To the best of my knowledge and belief, this work contains no material previously published or written by another person except where due reference is made.

Signed

Date

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Preface

The researcher's relationship with Robina

The researcher has resided in Robina in 1995/6 and again from 2001 to the present day. The experience of living in the suburb has given the researcher an understanding of the extent of car dependency inherent in the urban design of this suburb. The researcher's studies at Bond University in the Master of Urban Planning program built an awareness of urban morphology and its contribution to sustainable development.

The impression of the urban form of Robina gained during this time is that a car is essential to live in the town for nearly all journeys, as the goods, services and amenities are mostly located outside of the residential suburbs at some distance. There are only indirect routes to reach the neighbouring suburbs within Robina and the adjacent suburbs of Burleigh Waters, Clear Island Waters, Mermaid Waters, Merrimac, Mudgeeraba and Varsity Lakes.

Public bus transport is inadequate, often requiring a long walk to a bus stop. It starts too late to connect to the commuter train service to Brisbane and finishes too early to return from long trips. Its frequency is inadequate during the day to make short local trips practical. It can be unreliable and the timetabling is not coordinated with rail transport, allowing trains to leave before the buses arrive at the railway station and conversely buses leaving just before trains arrive.

The Railway Station, Robina High School and the Hospital are inappropriately positioned for residents and difficult to get to by public transport. Students in Robina face a difficult choice of schools, as very few students resident in Robina are able to walk to school, either to Robina State School or Varsity College in the neighbouring suburb of Varsity Lakes.

The lack of walkable destinations within the residential suburbs leads to very few people walking on the streets; most walkers are either exercising themselves or their dogs. Very few people are observed cycling; most cyclists observed appear to be training or in cycling clubs and taking advantage of the strenuous local conditions. This means that

although the streets are often visually attractive there is no sense of a social street life or active streets. There is little motivation for walking or cycling as there is nowhere to walk or cycle to, with goods, services and employment for most residents being well over twenty minutes walk away. The terrain with its steep slopes, combined with the sub-tropical climate, and a general lack of shaded pathways can make a summer's day walk of over ten minutes a hot and sticky experience.

The development of Robina separates land uses and creates hectares of homogenous residential development by size of house, style, and setting. The pocket parks do not provide any amenity but appear to be developers' decorations for ends of cul-de-sacs and places that would be difficult to build on, in order to meet the green space requirements of planning regulations. The residential neighbourhoods are also isolated from each other by planned and built barriers.

The street layouts, road designs and building frontages act against building social capital and isolate neighbours from each other. There has been a noticeable move towards new homes being built behind high walls and electronically controlled gates. There is also an evident trend for residents of the older homes in the suburbs that had garden frontages to erect new fences and retrofit themselves to look like the newer homes.

The design of streets and lots takes little account of passive solar orientation. The externalised costs of car dependent urban sprawl are borne by the residents on a perpetual basis with residents having to drive long distances to destinations that in a straight line are actually quite close.

This researcher accepts and acknowledges that the experience of living in the suburb and attempting to drive, walk or catch a bus to destinations that are physically close but difficult and distant by road or pathway has led to the development of a bias against the urban design of Robina that has motivated this research project.

Glossary

Key Definitions

Accessibility

Studies have found an association between the availability, proximity and quality of open space, parks, walking and cycling paths and increased physical activity for recreation. In some cases, there is also an association with access to transport. A key motivator for regular physical activity, especially walking is a variety of local destinations within easy walking distance usually within 5–10 minutes/400 metres of the home, or work and rarely further away than 20 minutes. (Australian Local Government Association et al., 2008).

Amenity

Amenity is a term meaning “the quality of being pleasant” and is widely used in planning to describe one of its principal objectives. Amenity is a composite of aesthetic and environmental qualities. These can be private views, privacy, quiet, sitting out space, landscaped and play spaces, and other recreational facilities or public views from public spaces, pleasant streets, furnishings, landscaping public spaces, and public art (Punter, 2003)

Connectivity

Connectivity is the degree to which networks - streets, railways, walking and cycling routes, services and infrastructure - interconnect. Good connections encourage access within a region, city, town or neighbourhood (Ministry of the Environment New Zealand, 2001).

Connectivity is also described as the directness of travel between destinations, which is influenced by the kinds of intersections and their density in a given area (Australian Local Government Association et al., 2008)

An interconnected street system encourages walking, bicycling, and transit use, and can reduce the number of and length of automobile trips. Local traffic is diffused over several smaller streets rather than focused on a few congested arterials where it is combined with through regional traffic, allowing greater flexibility in street design (Metropolitan Council, 2003).

Urban connectivity in the context of this research project has been defined as *The degree to which the urban form allows people to travel to retail, education, health, employment, professional, social and recreational facilities from their homes on foot, by bicycle, public transport or private vehicle.*

Density

Refers to site density, net dwelling density and gross dwelling density. Except where referenced, all density definitions are from the Queensland Transport document “Shaping Up” (Queensland Government, 2008).

Net residential density: A measure of housing density expressed as dwellings or lots per hectare, calculated by adding the area of residential lots plus the area of local roads and parks, and then divided by the number of dwellings or residential lots created (Queensland Government, 2005).

Net Dwelling Density: means the number of dwellings on the land occupied by dwellings plus internal public streets and incidental open spaces.

Gross Dwelling Density: Means the number of dwellings on the land occupied by dwellings plus local streets, open spaces, shops and service premises, primary schools, and half the width of adjoining sub-arterial or arterial roads.

Site Density: Means the ratio of dwellings and the site area they occupy. The land area excludes local streets, open space and any other land not directly related to the dwellings.

Density Gradient: Placing the most intense site density an area closest to an activity centre, and site density is gradually reduced as the distance increase from the activity centre and development sites. It provides for a mix of housing and development, which supports the provision of effective public transport.

Externality

In economics, an externality is an impact on any party not directly involved in an economic decision. An externality occurs when an economic activity causes external costs or external benefits to third party stakeholders who did not directly effect the economic transaction (Wikipedia)

Externality is a factor, for example environmental damage, that results in the way something is produced is not taken into account in establishing the market price of the goods or materials concerned (Encarta)

Local

Relating to, situated in, or providing a service for a particular area, especially the area near home or work (Encarta, 2008). In this research project local refers to the town of Robina and its neighbouring suburbs of Varsity Lakes, Burleigh Waters, Mermaid Waters, Clear Island Waters, Merrimac and Mudgeeraba (see figure 4).

Masterplanned Community (MPC)

Masterplanned communities are defined as private sector driven; large scale integrated housing developments on 'greenfield' sites in the outskirts of the cities (Minery and Bajracharya, 1999; Gwyther, 2005). MPCs usually have a mix of housing types, shopping and services, open spaces and recreation facilities, and sometimes employment opportunities. In most cases, MPCs are a product of long-term, multi-phase development programs that combine complementary mix of land uses (Schmitz and Bookout, 1998).

Master plan: A comprehensive plan that describes and maps the overall development concept for an area or precinct, including present and future land use, detailed urban design and landscaping, built form, infrastructure and service provision (Queensland Government, 2005).

Ped Shed

Ped shed is short for *pedestrian shed*, the basic building block of walkable neighborhoods. A ped shed is the area encompassed by the walking distance from a town or neighborhood centre. Ped sheds are often defined as the area covered by a 5-minute walk (about 0.25 miles, 1,320 feet, or 400 meters). They may be drawn as perfect circles, but in practice ped sheds have irregular shapes because they cover the actual distance walked, not the linear (crow flies) distance. A synonym for ped shed is *walkable catchment* (Shed, 2008).

Proximity

Proximity reflects two land use variables: density (or compactness) of land use and land use mix (the degree of homogeneity or the extent to which different uses are co-located in space). Two of the most important factors in determining the 'walkability' of an area are the proximity (how close destinations are to walk to) and the connectivity (how direct the routes of travel are). Urban environments, which are compact and intermixed, create shorter distances (proximity) between desired destinations, thus encouraging people to walk. This reinforces the notion that spatial landform patterns, population density and mixed land use of an area are interrelated and all encourage walking (Australian Local Government Association et al., 2008)

Sustainability and Urban Sustainability

Sustainable means able to be maintained and, using its associated ecological meaning, refers to exploiting natural resources without destroying the ecological balance of a particular area (Encarta World English Dictionary)

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (The Brundlandt Commission, 1987).

Planning for sustainability identifies a process that considers a community's on-site natural land, water air and energy resources as integral aspects of the design. It integrates natural systems with human patterns and celebrates continuity, uniqueness, and place making (Viera, 1993; and Early, 1993; in Jenks page 221)

The Centre for Sustainable Cities (2008) defines urban sustainability as a local, informed, participatory, balance-seeking process, operating within an equitable ecological region, exporting no problems beyond its territory or into the future.

Walkability

Walkability has been developed as a measure to assess the relative characteristics of different urban forms and designs. Questions about residential density, land use mix, accessibility, street networks and connectedness, walking/cycling facilities, aesthetics and safety are often included (Australian Local Government Association et al., 2008)

Walkable communities: give people a variety of destinations within walking distance of home, and safe and connected streets and pathways to get there (Australian Local Government Association et al., 2008)

Abbreviations Used

ABS	Australian Bureau of Statistics
GCCC	Gold Coast City Council
GCPS	Gold Coast Planning Scheme
GHG	Green House Gas
IPA	Integrated Planning Act
LGMS	Local Growth Management Strategy
LUPTAI	Land Use and Public Transport Accessibility Index
MPC	Master Planned Community
PIA	Planning Institute of Australia
RDI	Road Deviation Index
RLC	Robina Land Corporation
SEQRP	South East Queensland Regional Plan
Kgs	Kilograms
km/h	Kilometres per hour

1.0 Introduction

“The Robina Residential Archipelago: Its current and future sustainability” is an examination of the nature of urban connectivity for the residents of the suburbs of Robina. The research questions the developer’s claims to Robina’s being an environmentally sustainable development, as made on its current website:

“A relaxed, quietly efficient, well-planned network of precincts and business spaces with everything you need within walking distance. These days people call it environmentally sustainable development” (CBD Robina, 2008).

The research project is intended to inform the debate on the urban design of communities and their current and future sustainability. A literature review was conducted of current and historical theories and ideas on sustainable urban development. Interviews with key informed people were intended, where possible, to clarify information and seek perspectives for political solutions to the current urban design disconnect. Robina Woods Golf Course declined to take part and Robina Land Corporation were unable to direct the researcher to anyone with knowledge of the early development. Margaret May the Federal MP was unable to contribute as she was in a sitting of Federal Parliament.

1.1 The Robina Residential Archipelago

The term Residential Archipelago has been adopted to describe the fragmented residential urban form of Robina. This arose from the graphical analysis of the land uses of the town, where the residential islands can be seen as a disconnected string separated by various barriers (see section 3). These barriers make travel for residents difficult except by car. This is analogous to the difficulties encountered by inhabitants of small, island archipelagos surrounded by sea that are dependent on small boats to reach neighbours and larger islands that provide goods, services, and employment.

The research project seeks to understand the barriers to connectivity for the residents of Robina, how these barriers affect mobility choices, and the impacts of those barriers on residents. The project will also briefly consider ways that residents, government and de-

velopers can improve the existing levels of connectivity and enhance the liveability of the town to make it a more sustainable, vibrant, compact, adaptable and resilient place for its residents to live, work and enjoy.

The actual residential development of Robina has been difficult to trace in the publicly available written record. The earliest masterplan that could be found for the residential development of the suburbs of Robina Woods, Robina Waters and Robina Quays is 1991 (see Figure 1.1). Development of the town started in the early 1980s.

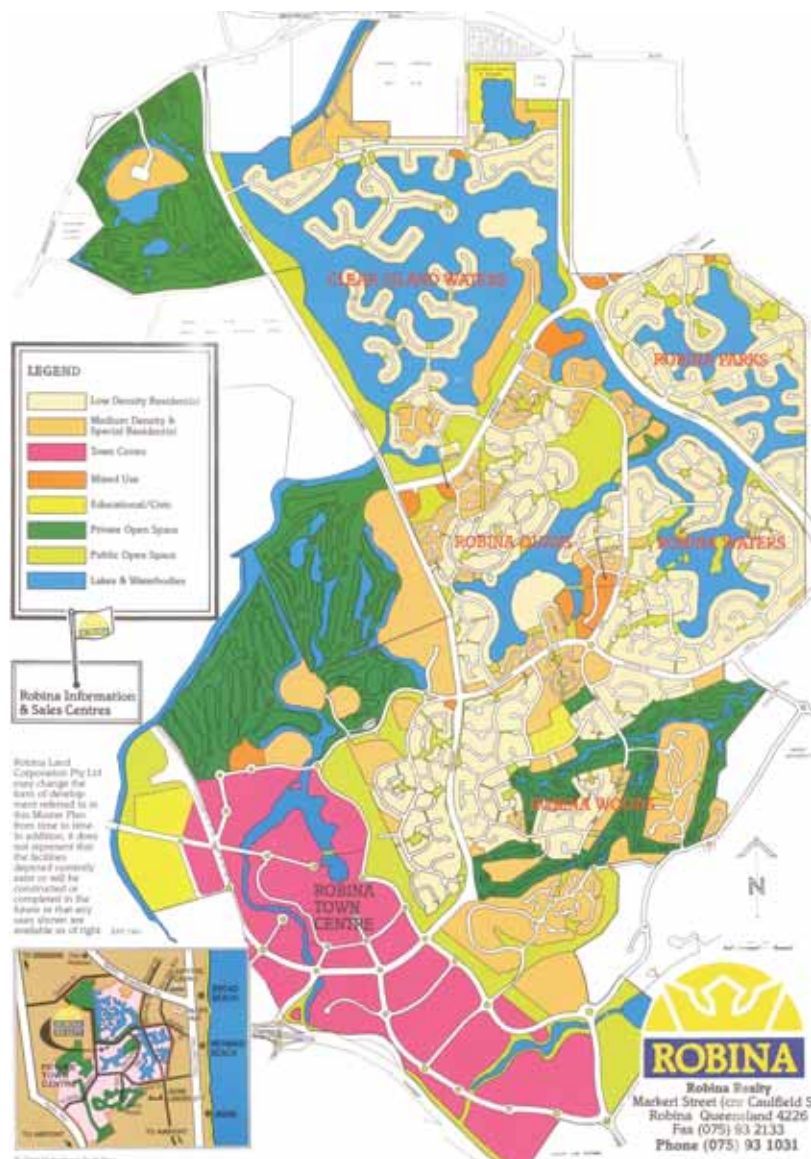


Figure 1.1: 1991 Robina Master Plan, showing density and street layout

The majority of the master planning that can be found describes the commercial and residential precincts of Robina Town Centre. This may be due to the residential development starting in the 1980s being before the widespread adoption of digital records. Another explanation may be found in the structure of the Robina Land Corporation in 1999 (Robina Land Corporation, 1999). The development group had eight divisions:

1. Robina Land Corporation (now CBD Robina)
2. Robina Planning
3. Robina Realty
4. Robina Design Service
5. Robina Nursery
6. Robina Woods Golf Course
7. ROTAN (It is not known what this stood for)
8. Robina Town Centre (A joint venture with Commonwealth Funds Management)

Robina Planning, Robina Design Service, Robina Nursery and ROTAN appear to have been wound up after serving their initial marketing, planning or development functions. This may have led to important sources being lost or publicly unavailable. The Focus on the commercial town centre for the Robina Land Corporation (Robina Land Corporation, 1999) and the possibility of the residential subdivisions having been built by other developers may also have contributed to a lack of detail for the residential masterplan available to this researcher.

1.2 The research questions

The questions chosen to guide this research project are:

1. What is the current nature of the urban connectivity of Robina?
2. How does the current urban design and connectivity impact on the residents of the suburbs?
3. What measures could be taken to improve the urban design and connectivity?

1.3 The research focus

The research paper seeks to describe historical and contemporary viewpoints of urban design and connectivity. It investigates the mobility choices that residents have and how the size and shape of the residential islands, the hierarchical layout of streets, and the identified barriers to connectivity affect mobility. The research paper also seeks to identify key sustainability issues for residents and how the current urban design of the residential islands affects them.

The research questions have been chosen to describe the current situation, attempt to establish how the current urban form impacts on the residents of Robina and consider opportunities for change. The paper will attempt to describe the benefits that may arise from changes to the current development, and new planning practices and government policies for the suburb.

1.4 The limits of the research

The case study is limited by the short time available to a single researcher, access to suitable maps, software and equipment. The case study is also limited by the relatively wide focus of determining the economic, social and environmental impacts on residents of the current urban form.

The original intent was to compare connectivity for all modes of transport but after initial enquiries the walkability of the town was seen as the most critical measure of connectivity for the residents. In initial field visits it was found that no local destination was over ten minutes by car from any residence in Robina. The study looked at the routes cars have to take from residences to destinations and the barriers the road hierarchy creates for pedestrians.

A definitive study of public transport in the Gold Coast known as LUPTAI (Pitot, Yigitcanlar, Sipe, & Evans, 2005) measured the Gold Coast public transport service and examined the accessibility of services for residents. Cycling connectivity was considered outside of the experience of this researcher; the climate and steep slopes also make cycling difficult

in Robina Woods. Walking was considered the key measure to examine the level of connectivity of the suburb for the majority of residents of all ages.

1.5 The context of the research

The research into the urban morphology of Robina is in the context of the debate on sustainable development. Robina at the time of its construction was the largest privately owned master planned community (MPC) in Australia (Robina Land Corporation, 1999).

Robina is one of the Principal Activity Centres on the Gold Coast and under the South East Queensland Regional Plan a key centre for managing growth for state and local government in the South East Queensland Regional Plan 2006 to 2026 (SEQRP) (Queensland Government, 2005) and detailed in the draft Gold Coast City Council (GCCC) Local Growth Management Strategy (LGMS) (Gold Coast City Council, 2007). Its urban design is like many other contemporary suburbs in Australia. The structure of the Gold Coast as a linear, coastal city contains other car dependent suburbs with similar or worse intentionally designed disconnect from neighbouring suburbs, goods, services, employment and amenities as shown in figures 1.2 and 1.3.

The future sustainability of these suburbs rests on the car. They are designed for access by car, they are not walkable neighbourhoods, and they have few destinations within their boundaries. Due to their low residential densities they are not able to be adequately served by public transport as density for transit oriented development needs to be between 30 and 80 dph or greater, (Queensland Government, 2005) table 7, page 77 SEQRP.

The lives of residents of these suburbs are dependent on the car being practical and affordable. The Gold Coast City Council in their LGMS state that residents in low density suburbs like Robina are likely to have more cars per household and make more trips by car (Gold Coast City Council, 2007). Those residents without cars, the infirm, the young and the elderly are isolated in the residential suburbs of Robina despite being in the geographical centre of the Gold Coast.



Figure 1.2: Aerial view of Clear Island Waters Gold Coast sourced from Google Earth



Figure 1.3: Aerial view of Broadbeach Waters Gold Coast sourced from Google Earth

The design of suburbs such as those found in Robina is seen as a significant contributor to the health problems that arise from low incidental exercise including obesity, cardiac disease, diabetes, hypertension, stress and depression (Australian Local Government Association et al., 2008).

The urban design of the suburbs with their hierarchical road structure is inefficient, causing cars, buses, service, and delivery vehicles to travel longer distances than would be the case with a more permeable urban structure. This leads to higher than necessary consumption of petrol releasing higher levels of green house gas (GHG) emissions than would be the case with an improved level of connectivity and permeability.

The current urban morphology is not seen as resilient to possible and probable stresses on the ability of residents to afford the car dependent lifestyle in the event of an economic recession. Other stresses that will test the residents are higher prices for fuel and food and the impacts of climate change (Garnaut, 2008) on the low lying flood prone suburbs of the Gold Coast including parts of Robina. These, along with peak oil (ASPO International, 2008) and its attendant threat to reliable petrol supplies and affordability may cause a decline in the popularity of similar residential archipelagos.

The social capital to deal with the stresses of the likely challenges of economic recession, climate change and peak oil are also adversely affected by the current urban form. Social capital has been found to be higher in communities with higher levels of physical activity participation (Australian Local Government Association et al., 2008). There is evidence that lower levels of available community support and higher levels of neighbourhood crime are associated with urban areas with poor walkability and urban connectivity (ibid).

The lack of diversity of housing in the suburbs of the Gold Coast also has implications for the relative value of homes of disconnected suburbs as against suburbs with more sustainable features such as mixed use development, street connectivity and provision for walking and cycling. This may be affected by changes in housing demand that will occur from the social change and the demographic shift expected in the next twenty years. Table 1.1 shows that the number of people who will be over 65 by 2025 will reach 20 per

cent of the population. Despite a preference for “ageing in place” (Australian Local Government Association et al., 2008) the demand for three to four bedroom homes is seen as likely to decline with an accompanying fall in the number of 15 to 64 year olds and changes to household formation patterns (Department of Family and Community Services, 2000).

Table 1.1 “ Measures of Ageing’ sourced from Australian Bureau of Statistics (ABS) website

Measure	Units	Australia				
		1955	1980	2005	2025	2050
Population	'000	9 200	14 695	20 329	24 679	28 081
Aged 0–14 years	%	29.0	25.3	19.6	16.5	15.1
Aged 15–64 years	%	62.6	65.1	67.3	63.1	59.2
Aged 65 years and over	%	8.4	9.6	13.1	20.3	25.7
Age ratio						
Young age(a)	no.	46.4	38.8	29.1	26.2	25.5
Older age(b)	no.	13.4	14.8	19.5	32.2	43.5
Total young and older age(c)	no.	59.8	53.5	48.6	58.4	69.0
Median age	years	30.1	29.4	36.7	41.6	45.2

More walkable neighbourhoods are a strategy to improve the physical activity level of older Australians, improve the quality of their lives and decrease the demands on the health care system (Australian Local Government Association et al., 2008)

1.6 Research methods and methodology

The research method chosen to answer the questions posed was to conduct a case study of the Robina Woods suburb to examine the spatial layout, and urban design features that determine the levels of connectivity for residents to neighbouring suburbs, and local goods, services and employment.

Robina Woods was chosen for the case study area as it is geographically the most central suburb in Robina/Varsity Lakes, lying between Varsity Lakes, Robina Town Centre,

Bond University and its neighbours of Robina Waters and Robina Quays as can be seen in figure 1.4.

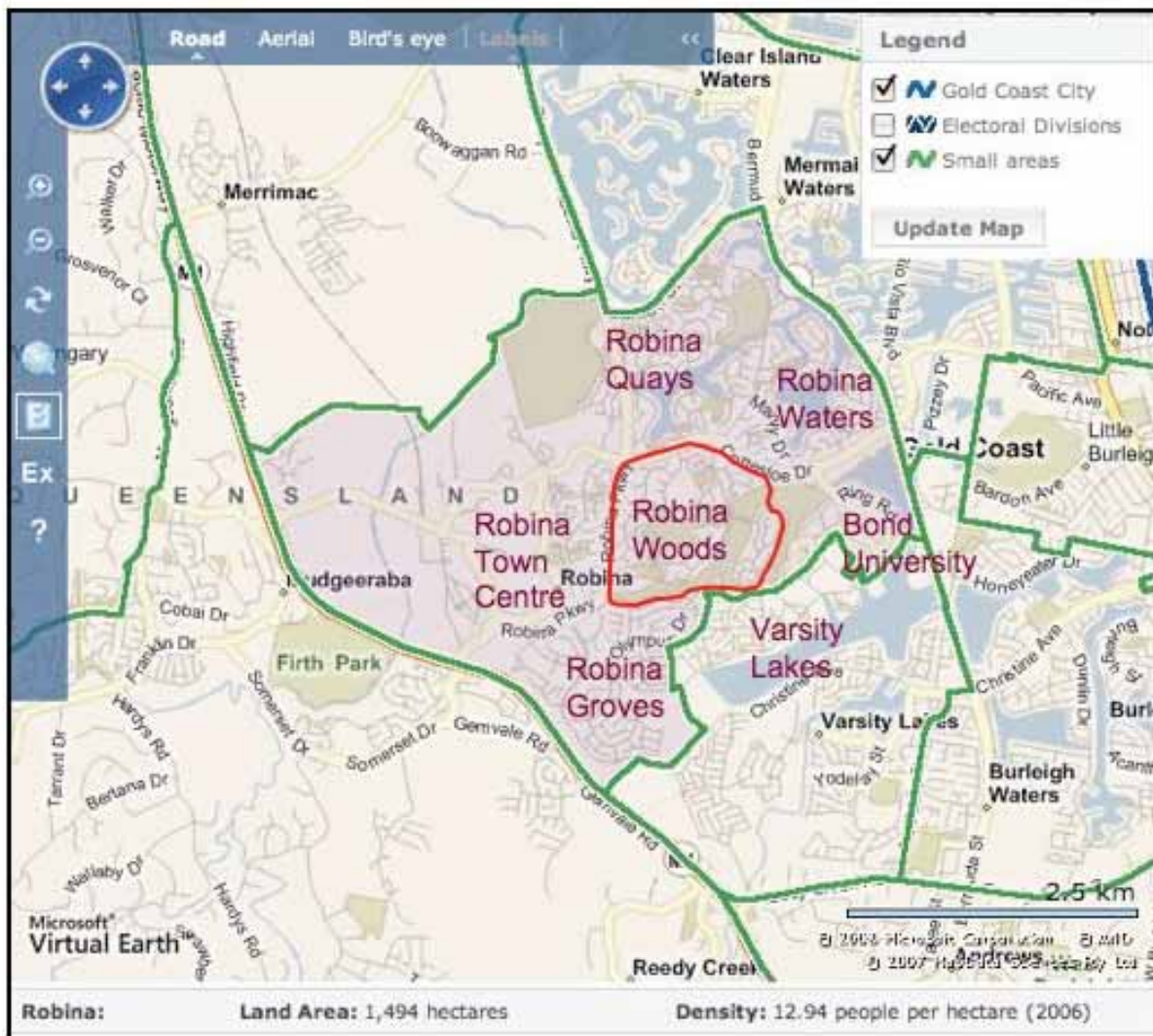


Figure 1.4: The location of Robina Woods, image adapted and sourced from GCCC website

The research compiled data for mobility/connectivity by utilising field research, primarily by mapping the actual distances and times to complete journeys. In order to attempt to understand the effect the identified barriers have on the residents of Robina Woods, ten residential addresses were selected for their position adjacent to barriers, proximity to destinations outside of the neighbourhood and their position in the suburb to represent the range of residences within the study area. The residences were numbered from one to ten (see figure 1.5).

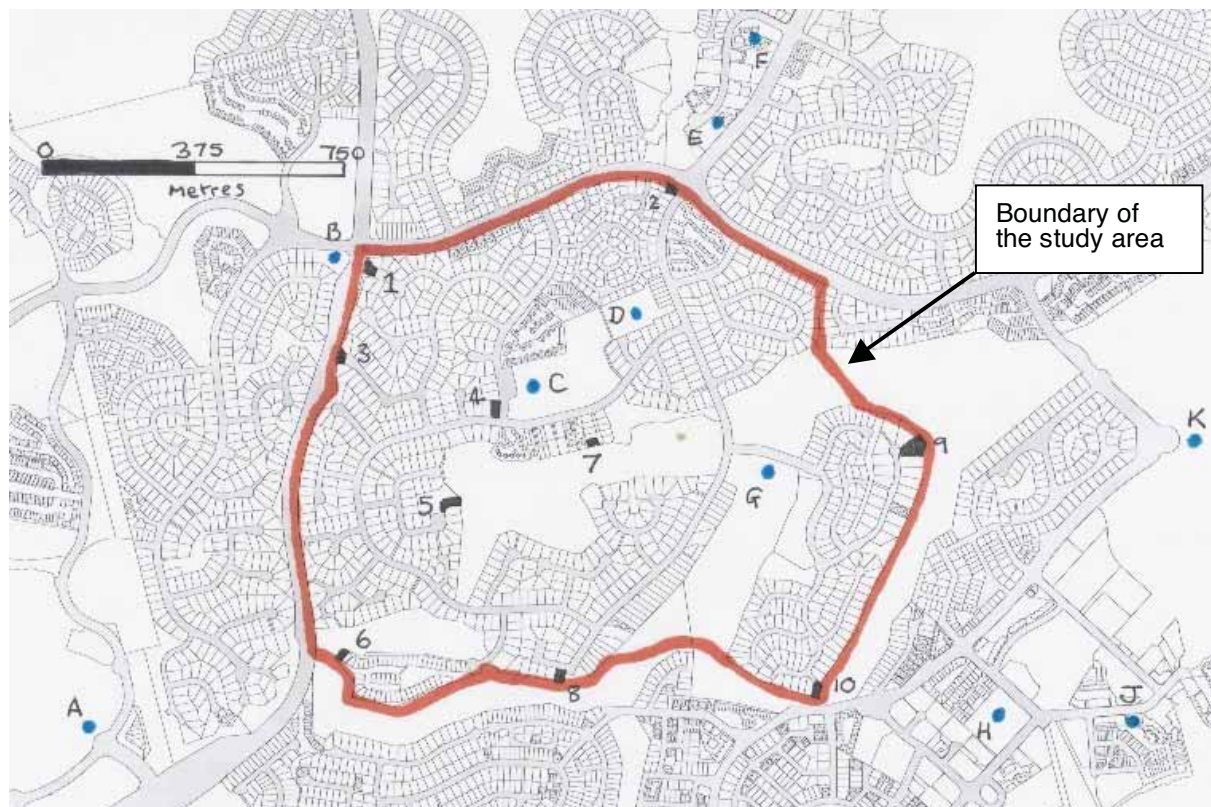


Figure 1.5: The selected residences and destinations of the study area (see table 1.2 for key)

The destinations chosen were all of the actual destinations within Robina Woods and adjacent destinations were north of Robina Woods. The major destinations of Robina Town Centre, Bond University, Varsity Lakes and Varsity College were chosen for their likely level of importance for residents. The local destinations outside of the suburb cover the range of the probable destinations for short trips by residents. The selected destinations are shown in figure 1.5, lettered A to K.

Other destinations considered for inclusion in the study, the Railway Station, the Q Retail Centre, Robina Hospital and Robina State School were not included, as they could not be practically reached by walking from Robina Woods. The goods, services and amenities available at each of the destinations are described in table 1.2.

Table 1.2: The selected destinations local to Robina Woods

Destination	Address	Goods, Services and Amenities
A	Robina Town Centre	Five major retailers, 6 screen cinema, and over 200 specialty shops, medical and financial service outlets. 6000 car parking spaces
B	Parkway Medical Centre	GP surgery, pharmacy, Pilate's studio, hairdressers, Thai restaurant, personal trainer, remedial massage, osteopath, naturopath, pathology laboratory.
C	Robina State School	Pre-school and Primary school with around 960 students
D	Robina Bowls Club	Sports club and bistro
E	The Quays Shopping Centre	Robina tavern; meals, gambling and drive through alcohol sales. Petrol station; convenience goods and car wash. Childcare centre, chemist, dentist, 3 solicitors, 2 cafés, 6 restaurants, 2 real estate offices, 4 financial services, surgery, 6 health services, 8 specialty stores.
F	Robina Village Shops	Newsagent, bakery, chemist, 3 real estate agents, IGA store, butchers, barbers, pet shop, dentist, florists, bookshop, RSPCA op shop, Veterinarians, 3 restaurants, public telephone and post box.
G	Robina Woods Golf Course	Private club, tennis courts and wedding chapel
H	Varsity College	Middle and Senior School with around 2700 students
J	Market Square Varsity Lakes	Bank of Queensland and ATM, Bendigo Bank, 5 cafes, 4 takeaways, 5 restaurants, 4 real estate agents, 2 hairdressers, 2 beauty salons, jewellers, fashion shop, office services, travel office, developers office, video store, pharmacy, home-wares, newsagent, liquor outlet, tavern, florist, gp surgery, dentist, IGA store, post box.
K	Bond University	Australia's largest Private University with 2800 students

1.7 Analysis of the urban connectivity of Robina Woods

The analysis of urban connectivity in Robina Woods was conducted with a focus on pedestrian connectivity and the directness of the road system for private vehicles. The pedestrian analysis was conducted using maps to trace the distances and routes available to the residents of each home. The analysis of the road network was also conducted using maps that traced the routes of vehicles from selected destinations to the homes of residents. The results were audited by the researcher traveling along representative routes for each analysis to verify travel time and record the conditions to be found along the route.

1.8 The selected walking speed

The walking speed adopted for this research project is 4.5 km/h per hour, giving a walking distance of 375 metres in 5 minutes and 750 metres in 10 minutes. This has been converted from studies indicating older pedestrians walk at 4.11 ft per second (US Roads 2008). The lower distance is seen as more appropriate than the usually quoted 400 and 800 meters as pedestrians are usually either younger or older than average (US Roads, 2008). The lower speed also allows for climate, terrain and slope. The quote by Bernard Isaacs, *Design for the young and you exclude the old; design for the old and you include the young* cited in (Australian Local Government Association et al., 2008) is also seen as supporting a lower walking speed.

2.0 The planning of new settlements and connectivity

Many writers have written and commented on the disadvantages of car dependent sprawl in the urban form (Calthorpe, 2001; Cervero, 2007; Jenks & Dempsey, 2005) with its attendant negative social, environmental and financial implications (Moah and Kanaralou 2007; (Behan, Maoh, & Kanaroglou, 2007)). Despite this, it is noted that the market-oriented urban sprawl evident in Robina has continued to be promoted as sustainable development (CBD Robina, 2008).

Towns and cities historically appear to have either evolved haphazardly over time or were founded in response to social and economic need for new settlements (Haverfield, 1913). Robina was a response to the growth that South East Queensland was and is experiencing (Queensland Government Office of Urban Management, 2005). Its urban form is dominated by the power of the market. It can be argued that its urban design intent was to deliver customers to its commercial and shopping hub. The mode of transport chosen for the delivery of those customers to the market was the private car. The residential suburbs were designed primarily from a marketing focus to promote an attractive aesthetic and a high degree of personal privacy (Robina Land Corporation, 1999). From this perspective, Robina can be said to be a very successful example of the development model chosen.

The role of government as arbiter of economic forces for social justice and oversight of efficient governance of communities appears not to have operated in the development of Robina. The market forces that drove the shape and form of Robina have built in externalised costs for the residents and ratepayers of the Gold Coast for the foreseeable future (Wackernagel and Rees, 1996, cited in (Jenks & Dempsey, 2005). The developers, designers, engineers, marketers, planners and politicians have erected barriers to connectivity in Robina that have created islands of isolated residential development dependent on the private car as its only future major mobility choice.

In choosing development profits over future sustainability (The Brundtlandt Commission, 1987), (Queensland Government, 2008), the accumulated wisdom of centuries has been

overlooked and an opportunity to create a model of development has been missed. It would appear that prudence in regulating and controlling development by the state government and local council could have avoided the future costs of reversing and retrofitting current development. This includes the maintenance and repair of ageing infrastructure with a low-density residential rateable base, provision of adequate social infrastructure, subsidy of low viability public transport and a need to promote a reduction in car dependency and its associated health risks and environmental damage (Australian Local Government Association et al., 2008).

2.1 The political approaches to urban design

Planning operates in a social, economic, environmental and political context (England, 2004). There have been and continue to be many different forms of political response to urban design.¹ Historically they could be characterised as:

1. Impotent: where a politically, morally, or financially bankrupt, incompetent or corrupt, government is unable or unwilling to influence or control development. This can occur in advanced and developing countries and is characterised by the uncontrolled urban development this can occur in countries like the United States or shantytowns in third world countries.
2. Indifferent: where the government lacks the political vision, will, or power to make decisions on urban development. This can be a response in various forms and combinations in many societies.
3. Laissez Faire: where the government believes that market forces are the arbiters of the urban form and government interference is unwarranted in the organic development of urban form, common in United Kingdom and the United States.
4. Colonial: where a dominant and imperial government makes decisions on political, religious, or cultural grounds that determine the urban form such as Roman colonia, Imperial France and Germany or Communist era workers' paradises.

¹ This suggested list is an initial attempt by the author to characterise political responses to urban design.

5. Municipal; where a powerful or wealthy, localized, controlling group engineer a town to fit their purposes. This can be seen in Ancient Greece, Renaissance Italy, and modern cities around the world such as Las Vegas, Bahrain or Abu Dhabi.
6. Interventionist; where governments react to public health, social or economic disasters to intervene, for example in slum clearances after World War Two, the rebuilding of London after the great fire; or the epidemics and social disorder common in crowded European towns in the nineteenth century
7. Structural; The dominant form of planning in western contemporary society, where the control of urban design is legislated, regulated and directed as an arm of political policy by elected representative government.
8. Collaborative; is an emerging form of governance (Australian National University, 2008) found in such cities such as Portland and Vancouver in which citizens participate in the decision and policy making process.

The development of Robina carried out as it was by a private company appears to have enjoyed a structural/laissez faire approach to planning from the responsible government bodies.

2.2 A historical perspective of new town planning

In a paper presented in 1910 at the University of London, Francis Haverfield stated that *“Town-planning--the art of laying out towns with due care for the health and comfort of inhabitants, for industrial and commercial efficiency, and for reasonable beauty of buildings--is an art of intermittent activity”*(Haverfield, 1913). Haverfield went on to demand that politicians ensure that towns should be planned for the health, convenience, and occupations of their probable tenants. Haverfield also observed that there were two conditions necessary for successful town planning *“the wit enough to care for the well-being of common men and the due arrangement of ordinary dwellings”*. He identified the Romans as having perfected the art and science of town planning.

The Romans built towns to colonise their conquests, and they were usually founded as places for their legionnaires to settle. In form they resembled the forts that the Roman

armies built. Interestingly the towns were intended to be self sufficient and relied on their hinterland for most goods and services. They differed from the army forts in having civic functions like forums, markets, temples, courts, and entertainment within their boundaries. The street layout (see figure 6) typically had two main streets - the Cardo runs north to south and the Decuman west to east. In the residential areas there was a chessboard pattern of rectangular house blocks known as *insulae*.

The Roman town of Colchester in England is one such town; the town is useful in comparison to the chosen study area of Robina Woods in being designed for roughly the same population of approximately 3000 people.

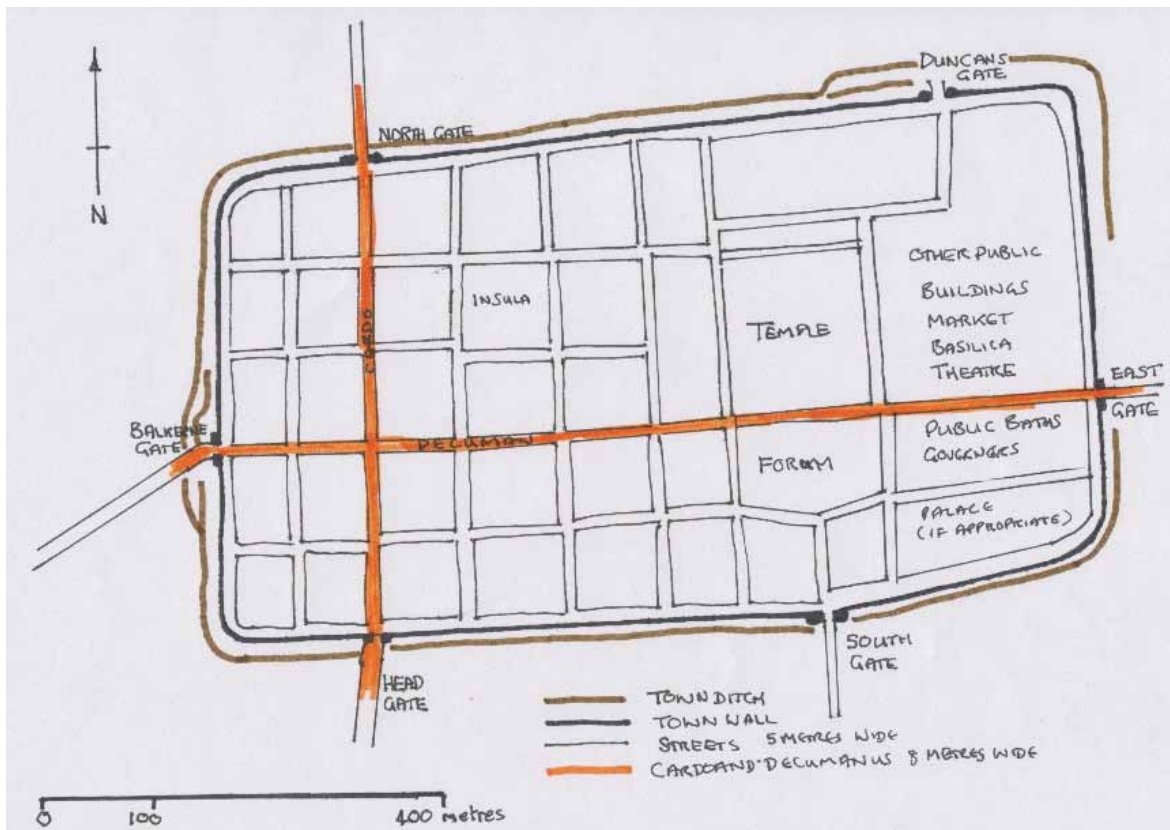


Figure 2.1: The street layout of Colchester circa 2nd century AD. Sourced and redrawn from <http://www.camulos.com/townwall.htm>

The researcher has lived in the town of Colchester and although later development has eroded the original Roman street pattern and commercial development has aggregated many of the blocks in the central area, much of it is as it was originally laid out. Colches-

ter is a vibrant town and despite being constrained by walls and on a prominent hill, it has more exits to its surrounding suburbs and greater connectivity both within and outside of its boundaries with access to most of the goods and services necessary for an urban lifestyle than the suburbs of Robina.

2.3 Urban form and connectivity

Urban connectivity in the context of this research project has been defined as *the degree to which the urban form allows people to travel to retail, education, health, employment, professional, social and recreational facilities from their homes on foot, by bicycle, public transport or private vehicle*. This may be seen as a definition of accessibility but in an urban context, connectivity without destinations for residents can be reasonably seen as of little use. The suburb of Robina Woods could be on a grid pattern but the number of destinations within the suburb would still make it a disconnected urban form.

The last two centuries have seen a transformation in cities from being relatively contained to widespread urban sprawl. This has been a worldwide phenomenon. The strengthening of international capital has led to the concentration of economic power in a number of global centres of finance and highly specialised services (Sassen, 2001; Smith 2002 in (Jenks & Dempsey, 2005).

This globalisation has also led to fewer local developers and the emergence of large corporate developers who prefer and need the release of green field sites for their profitability. This has been commented on in a recent article in the *Courier Mail* (McCarthy, 2008) who reports that 54 per cent of the land in the development pipeline on the Sunshine Coast is held by just three companies, Stockland, Springfield Land Corporation and Delfin Lend Lease. In the article Professor Phil Heywood of the Queensland University of Technology was quoted as saying that, *“there was a risk that too much land in too few hands could constrain supply, but it could also prevent new players from entering the market.”*

This trend towards large scale developers and the resulting developments has led to a reaction amongst urban design and planning theorists which is directed at the car dependent and sprawling MPCs that were often a result of developers' activities in the past. Alonso (1964) and Muth (1969) indicated that the nature of connectivity is related to the concepts of car dependency and urban sprawl. "*The spatial structure of cities is determined by households balancing commuting costs against housing costs in search of an optimal location*". This has led to many of society's most vulnerable people being forced to live at considerable distances from goods, services and employment (Dodson & Sipe, 2005).

The emergence of the new urbanist movement in the 1990s was a direct result of the urban sprawl witnessed across the developed world but especially in the United States. This movement went through an evolution of principles for public policy, development practice and urban planning intended to provide density, diversity and connectivity and a return to neighbourhoods that are walkable, defined and publicly accessible, through citizen based participatory planning and design (Congress for the New Urbanism, 1996).

There were other responses to the problems created by urban sprawl and car dependent neighbourhoods, including "Smart Growth" (Ewing, Bartholomew, Winkelman, Walters, & Chen, 2008). This is an approach which has gathered wide spread support from environmentalists, transport engineers, local government agencies, realtors, lawyers, community advocates, architects, urban designers and planners.

In the United States, various non-government and government groups have come together and formed the Smart Growth Network which is supported and sponsored by the Environmental Protection Agency (Smart Growth Online, 2007) to promote public awareness of the Smart Growth approach to planning. In brief, its policies and principles support development in a compact development model within the existing urban footprint to create a range of housing choices, walkable neighbourhoods, community participation in decision making, mixed land uses, and urban design which fosters a sense of place and uses compact building design. It also seeks to preserve open space, farmland, and envi-

ronmental areas and make development decisions predictable, fair, and cost effective (Smart Growth Online, 2007).

2.4 How planning can help to determine urban connectivity

The Planning Institute of Australia, in conjunction with the Heart Foundation and the Australian Local Government Association, has produced a draft document which intends to provide a national perspective on the nexus between health and the built environment (Australian Local Government Association et al., 2008). This promises to be a significant step forward in articulating and mobilising support for change and debate over guidelines for healthy neighbourhoods.

It has produced the *Introduction to Healthy Spaces and Places* draft document to encourage the inter-disciplinary co-operation it sees as part of the political process to initiate and encourage change. Originally intended to improve the welfare of older Australians it has been adapted to be for all Australians.

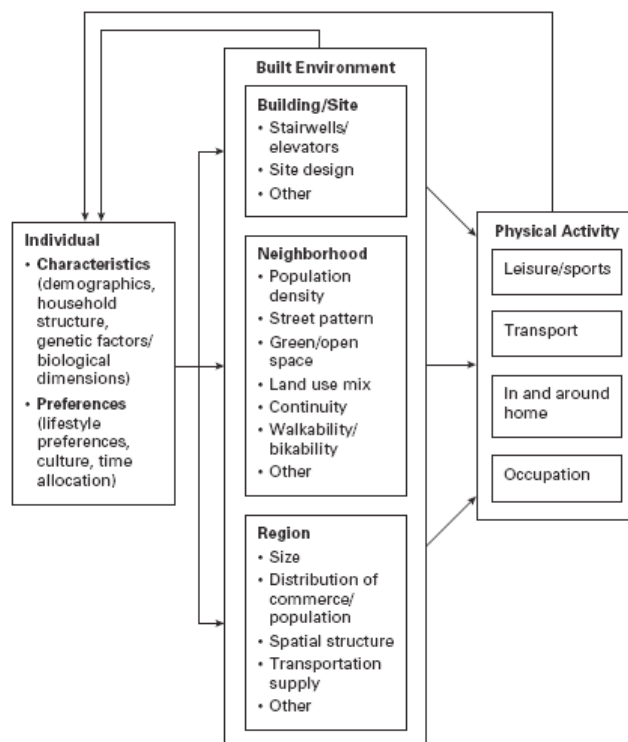


Figure 2.2: Influence of elements in the built environment on physical activity (Source: U.S. Transportation Research Board (2005))

The previous diagram illustrates the connections between the built environment, neighbourhood and region and its influence on individuals' choices to take part in physical activity. The paper goes on to identify major elements of the built environment and their influence on a range of planning outcomes, Accessibility, Affordability, Connectivity, Diversity and Proximity.

This was found to be a useful starting point in designing a mindmap of the factors that affect and determine urban connectivity (see Figure 2.3). The addition of Urban Design, Barriers, Mobility, Conditions, Safety, and Opportunity appears to offer tools to measure urban connectivity holistically.

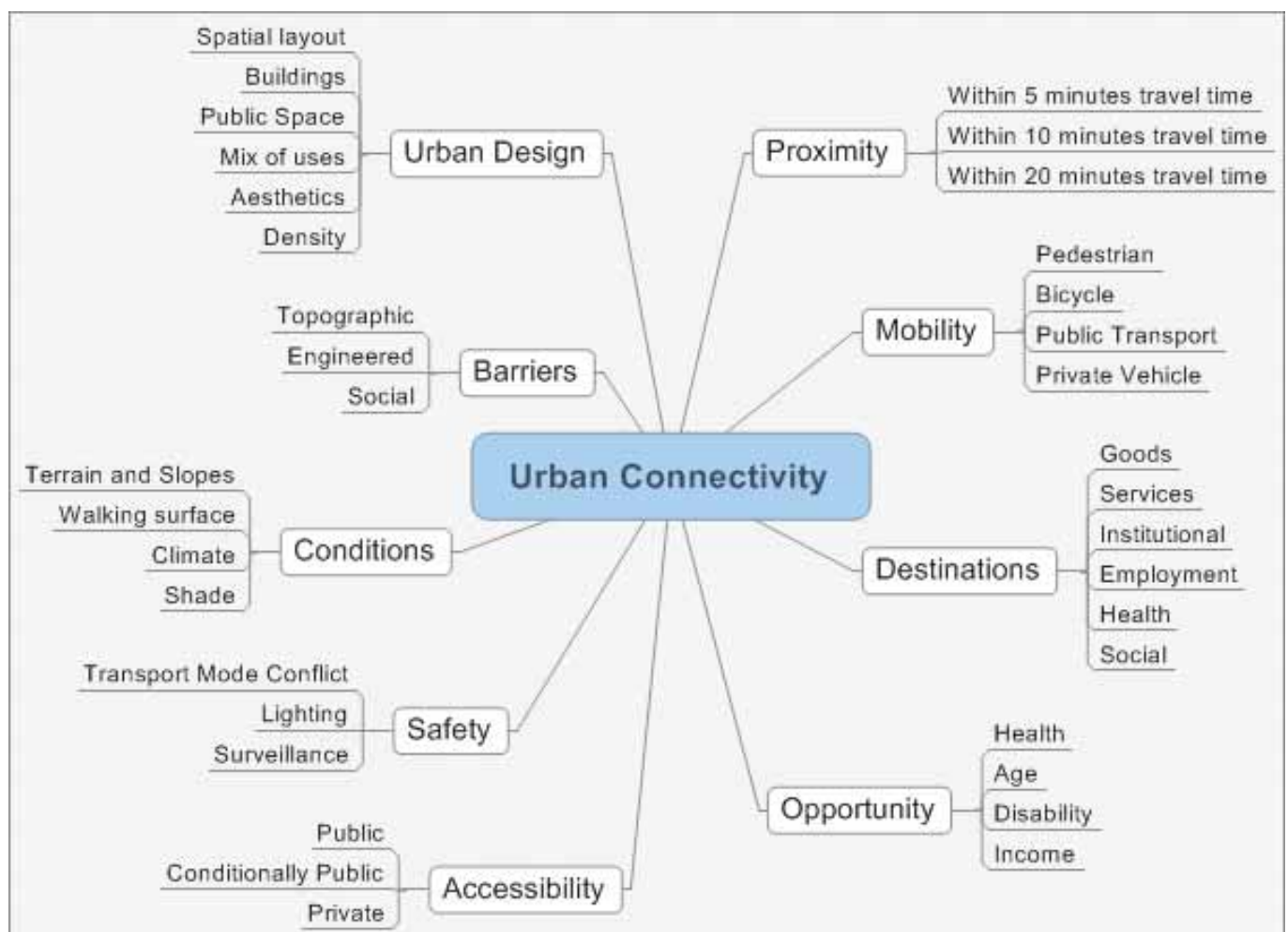


Figure 2.3: Proposed model of the factors that can determine urban connectivity (source: author)

2.5 Measuring urban connectivity

The high number of factors (see figure 2.3) that are capable of affecting connectivity in an urban context goes some way to explaining why a simple measure of connectivity is not capable of determining levels of connectivity in various contexts. It may also explain a lack of comprehensive description of how to achieve urban connectivity in the literature.

Although there are a number of measurements of aspects of connectivity available in the literature, none appear capable of taking into account all the factors that affect urban connectivity. Types of measurements encountered include:

- I. Measurement of Mixed density through the Mixed Density Index (Chu 2002)
- II. Measurement of the public transport accessibility index (Pitot, Yigitcanlar, Sipe, & Evans, 2005)
- III. Measurements of permeability such as number of intersections per hectare

These measures may be useful in some contexts and can help to inform decision making in particular scenarios. For this researcher's purpose, they were considered inadequate in describing the urban connectivity of the residents of Robina.

In the absence of a simple to use connectivity measure that the researcher can apply to the study area, the intent is to use the identified factors that affect and determine urban connectivity to describe the current urban form. The following combinations of factors will be used to attempt to describe connectivity in Robina's Residential Archipelago:

1. spatial layout of roads, streets and pathways
2. the effect of barriers on proximity
3. the influence of urban design and destinations on mobility choices
4. the effect of safety, environmental conditions and accessibility on opportunity

3.0 Robina in context

Robina is in the local government area of the Gold Coast City Council (GCCC) in the southeast corner of the state of Queensland. The Gold Coast is the second largest city in the state and the sixth largest city in Australia (Australian Bureau of Statistics, 2007). Robina was developed under its own act of Parliament. The then Robina Properties and Albert Shire Council entered into an agreement to develop a Masterplanned Community (MPC) (Queensland State Government, 1992). Robina is centrally located in the Gold Coast City with rail and road connections to the state capital city of Brisbane. It has air links from Brisbane Airport and Gold Coast Airport in the Southern Gold Coast to the rest of Australia and internationally. The South East Queensland Region is recognised as the fastest growing region in Australia (Office of Urban Management, 2005).

Gold Coast City Council like all local government authorities in Queensland operates under the authority of the State Government (Thompson, 2007). The overriding documents that govern planning in the Gold Coast are the Integrated Planning Act (IPA) (England, 2004,) the South East Queensland Regional Plan (SEQRP) and the local Gold Coast Planning Scheme (GCPS). The SEQRP designated Robina and Southport as the two Principal Regional Activity Centres in the Gold Coast in 2005 (Queensland Government, 2005).

3.1 The development of Robina

Robina was developed as a Masterplan Community on a green field site. In December 1980 a Singaporean developer, Robin Loh, and Arthur Earle, a local landowner and realtor, began to develop the town. Together they founded the Robina Land Corporation when they purchased a 1658-hectare site from the liquidators of the Cambridge Credit Company (Robina Land Corporation, 1999). The site for Robina Town Centre was known as the “Great Swamp” and largely used as dry season grazing for livestock. Neighbouring farms were purchased in 1981 bringing the land holding up to 1850 hectares (Gold Coast

City Council, 2008). The following image (figure 3.1) shows the original green field site and development up to 1996.

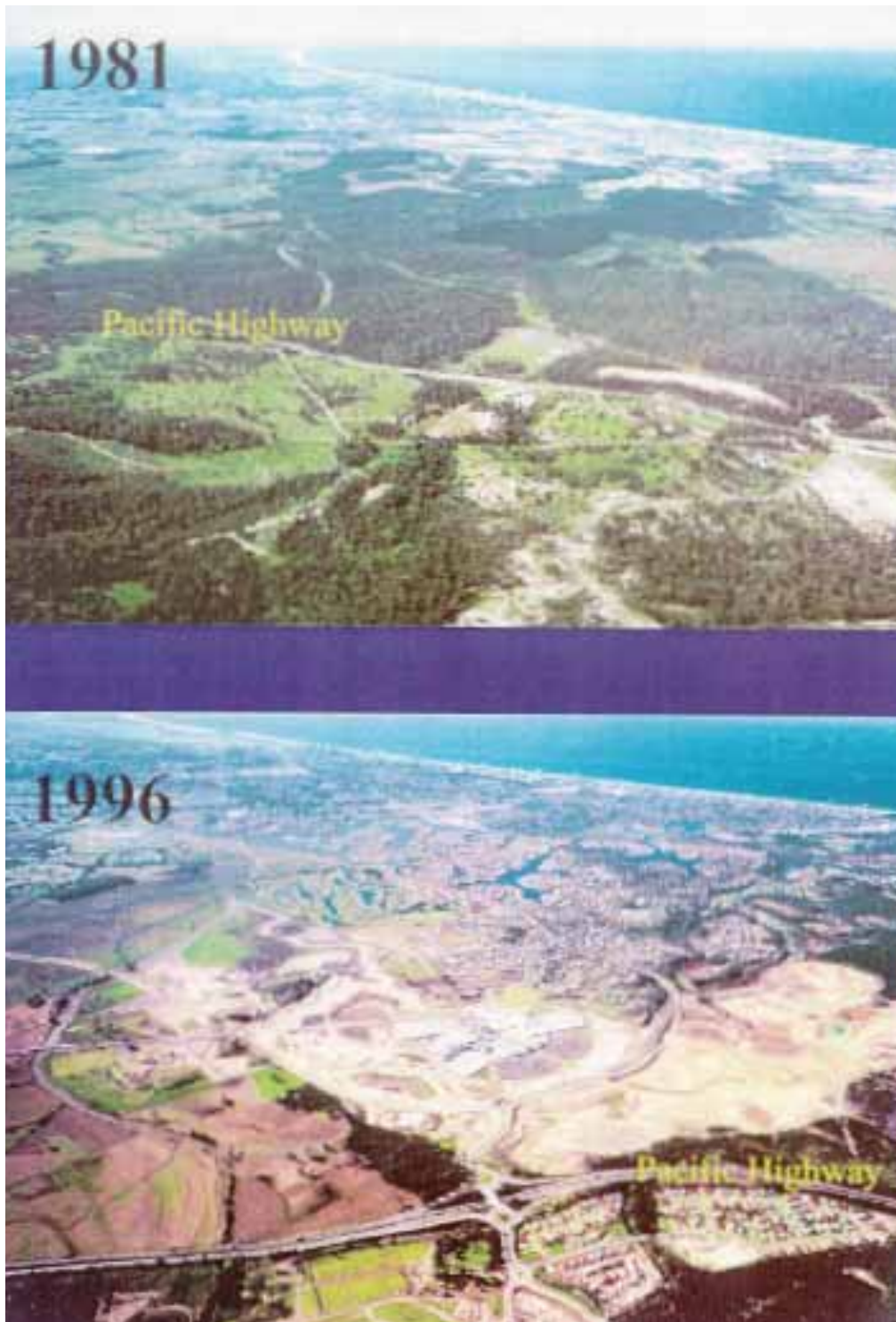


Figure 3.1 Aerial views of Robina in 1981 and 1996 sourced from “The Robina Profile” by Robina Land Corporation, Local Studies Library GCCC

In 1981 the first subdivision was put on the market and an urban planner, Moshe Safdie who was based in California, was commissioned to develop the master concept plan. Robina became Australia's largest privately owned, master planned community and was developed to act as the major commercial and community focus for the Gold Coast's permanent population (Robina Land Corporation, 1999).



Figure 3.2: The Gold Coast Urban Footprint in 1980 and 1997, sourced from "The Robina Profile" by Robina Land Corporation, Local Studies Library GCCC

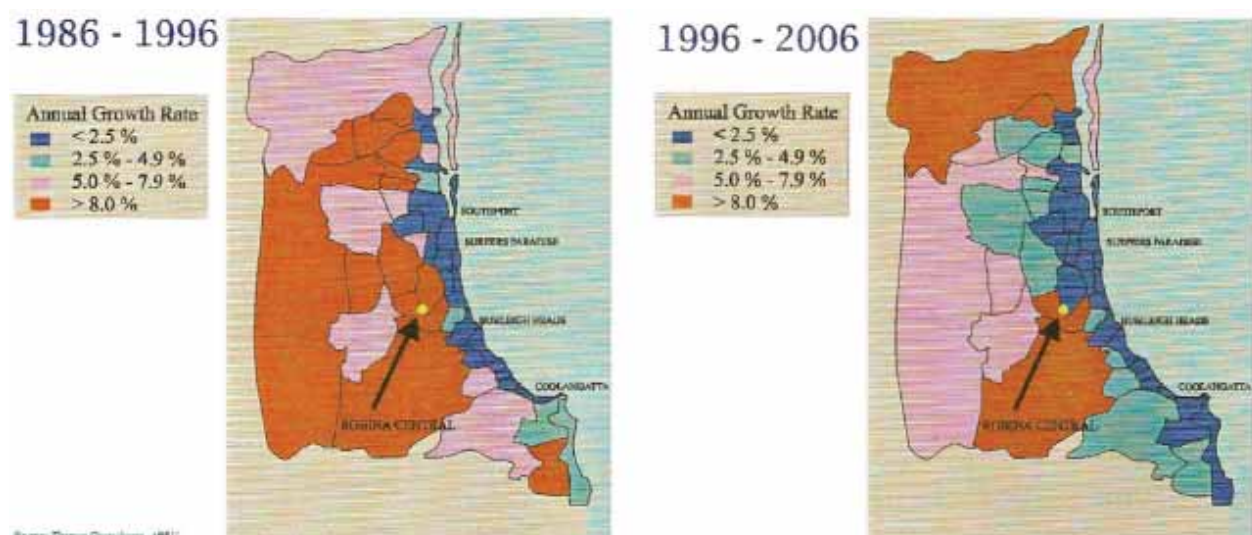


Figure 3.3: Population growth in the Gold Coast by suburb, sourced from "The Robina Profile" by Robina Land Corporation, Local Studies Library GCCC

Prior to the 1980s the urban footprint of the Gold Coast City was a linear strip along the coast (see figure 3.2). This figure also illustrates the geographical centrality of Robina and suggests the extent of the Gold Coast that can be reached in a ten and twenty minute drive time. Population growth in Robina was rapid in the period 1986 to 1996 (see figure 3.3) but slowed as development shifted to Varsity Lakes in the period 1996 to 2006.

3.2 The car dependent focus of the Robina development

The car focus of the Robina development can be seen from various sources, primarily from the Robina Profile prepared by the Robina Land Corporation (Robina Land Corporation, 1999) and its current webpage (CBD Robina, 2008a). Key statements, which support the idea of an intended car dependent development designed to deliver customers to the commercial and retail hub of Robina Town Centre, include the following quotes:

Unmatched vehicular accessibility with major arterial roads such as Robina Town Centre Drive, Robina Parkway, Cheltenham Drive, and Christine Avenue all radiating from the Robina Town Shopping Centre and providing easy and fast access in all directions (Robina Land Corporation, 1999)

To provide for long-term demands and avoid bottlenecks in surrounding streets, access roads to the site have been planned to handle up to 250,000 vehicle movements per day, twice the amount that crosses the Sydney Harbour Bridge each day (ibid).

In 1996 313,000 people (91 per cent of the Gold Coast population) live within a 20-minute drive from Robina, in 10 years this is expected to grow to 419,000 people (ibid)

The current website indicates the success of that planning for a car accessible Robina Town Centre with a drive time analysis conducted in 2008 by Conics Robina (CBD Robina, 2008b):

- 9 per cent of the population (*of the Gold Coast*) live within a 5 minute drive of Robina (Town Centre Shopping)
- 33 per cent of the population live within a 10 minute drive

- 79 per cent of the population live within a 20 minute drive
- 89 per cent of the population live within a 30 minute drive

The website also states that *Robina Parkway, the main entry to CBD Robina now records 35,217 vehicles per day which is a 34% increase since 2002. The other main entry point, Robina Town Centre Drive, now records 15,929 vehicles per day, which is an 11% increase since 2002.*

Considering that the designed capacity is 250,000 vehicle movements per day for the town centre roads this is far short of its capacity, suggesting that modifications to the current road hierarchy are quite possible without adversely affecting the carrying capacity of the arterial roads to meet demand. The current research investigates the scope for modifying the current road system to enhance urban connectivity, choice and mobility by dispersing traffic through a more connected local road network. This in combination with a more compact urban form would allow more growth within the existing urban footprint.

4.0 Describing the barriers to the urban connectivity of Robina

In the limited scope of this research project it was decided to identify some of the barriers that affect and determine the current urban connectivity of Robina. The walkability of the residential suburbs is the central focus of this case study. This research compiled data for mobility/connectivity by utilising field research, mapping the actual distances and times to complete journeys by foot. The first step taken was to examine the spatial layout of the suburb, to describe and map the barriers to connectivity in its design.

4.1 The consensus on the desirable qualities of urban connectivity

There is some consensus in contemporary sustainable design literature about urban connectivity. The Urban Design Alliance of Queensland (UDAL, 2005) writes about places being physically connected with a multitude of fine mesh through-routes that offer short journeys between places. This connectivity also needs clear visual signals of vistas and landmarks with delineated private and public places (Urban Design Alliance of Queensland (UDAL Qld), 2005). UDAL describes the qualities that those connections should have to meet peoples' needs as: *accessible to all members of the community, with pedestrian paths with good surfaces that avoid unnecessary steps and have adequate lighting.*

The influential Urban Design Compendium by English Partnerships (Llewellyn Davies, 2007) sees making connections as one of the key aspects of urban design. There is a strong emphasis on ease of movement, legibility, and permeability with developments being integrated into the existing urban form and natural built environment. The compendium seeks to address the needs of people to access jobs and key services from a walkable neighbourhood priority that creates a movement framework designed for people to feel safe, with a maximum choice for how people will make their journeys with clear connections. There is also advice on how to achieve this by mixed use development, compatible uses that combine primary activities of living and working and centres located at crossroads with an emphasis on the civic value of public space, edges, transition zones, density and form.

The compendium recommends the grid as the spatial model for mobility networks for pedestrians and vehicles alike (see Figure 4.1). The optimal grid spacing for this network is seen as 80 to 100 metres in most cases with a tighter 50 to 70 metres grid in areas with intensive pedestrian circulation (Llewellyn Davies, 2007).

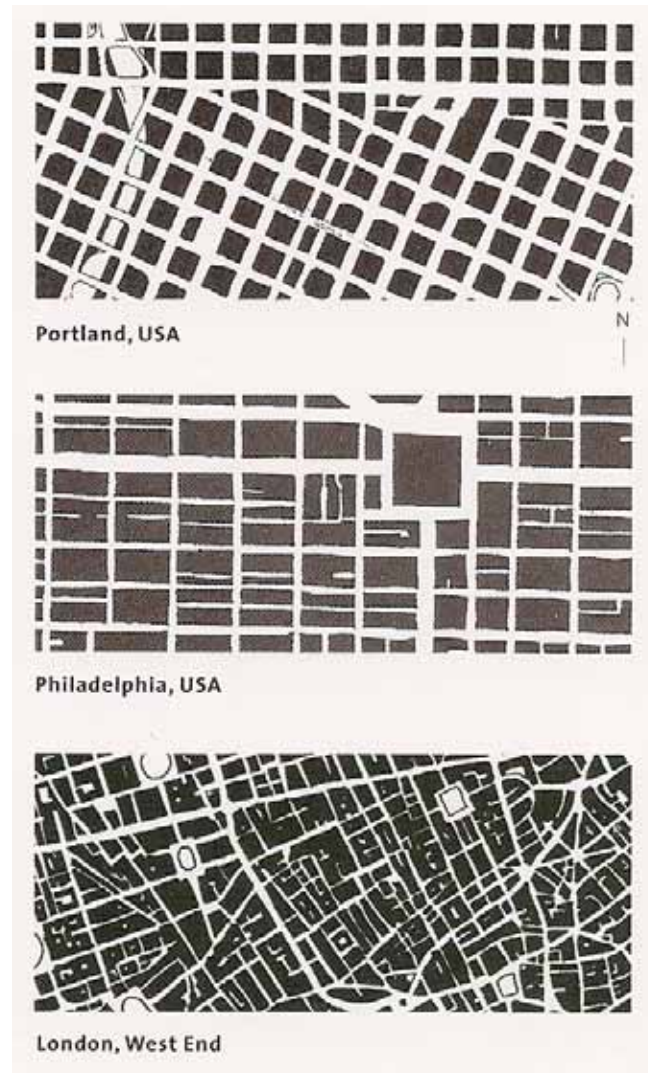


Figure 4.1: Example of street grids from the “Urban Design Compendium”

In the book “Urban Places Urban Spaces” (Carmona, Heath, Oc, & Tiesdell, 2003) the dimensions of urban design are seen as morphological, perceptual, social, visual, functional and temporal. In this the authors identify two types of urban form: “traditional” and “modernist”. They refer to work by Pope, 1996; and Bentley, 1998 as documenting

the change in the morphological structure of urban space from the traditional *integrated pattern of connected small-scale finely meshed street grids*, to *road networks surrounding segregated and introverted enclaves* of the modernist urban form. The later description is seen as applicable to the urban form of Robina.

4.2 The selected study areas

The following diagrams (figures 4.2 and 4.3) give some sense of the road connectivity of the study area and an area chosen for comparison approximately five kilometres south of the CBD of Vancouver at the same scale. Vancouver was chosen, as with a population of around 600,000 it is similar to the population of the Gold Coast (Ip, 2007).



Figure 4.2: Aerial view of Robina Woods sourced from Google

The area of Vancouver selected is south of Van Dusen Botanical Gardens. It has Oakridge Shopping Centre on its fringe and contains two parks and a school. Its primary selection criteria was as a residential area on the same physical scale as Robina that had a grid pattern. It was also chosen for having some distortion in the grid caused by open spaces and large block destinations. Vancouver was chosen as it often makes the top ten in the world ratings for green and sustainable cities (Shepherd, 2007).



Figure 4.3: Aerial view of a suburb of Vancouver at the same scale

Comparing the two images of Robina Woods and Vancouver visually, it would appear that the housing lots are smaller in Vancouver. The streets are also more compact and there are distinct variations in the orientation and rhythm of the street patterns. There are many more three and four way street intersections in Vancouver compared to Robina. There are obvious main through routes with north to south and east to west routes reminiscent of the Roman layout of Colchester (see figure 2.1). Major destinations are near or at the major intersections; permeability and alternative route choices are very visible. There are no obvious barriers for residents of Vancouver to reach adjacent neighbourhoods. The school and other destinations are integrated into the street pattern.

The following diagrams (Figures 4.4 and 4.5) are an attempt to simplify and examine the nature of the road connectivity in Robina Woods and Vancouver. The red lines are the main roads and the orange lines indicate local residential roads. The arrows indicate if travel is possible beyond the end of the drawn line.

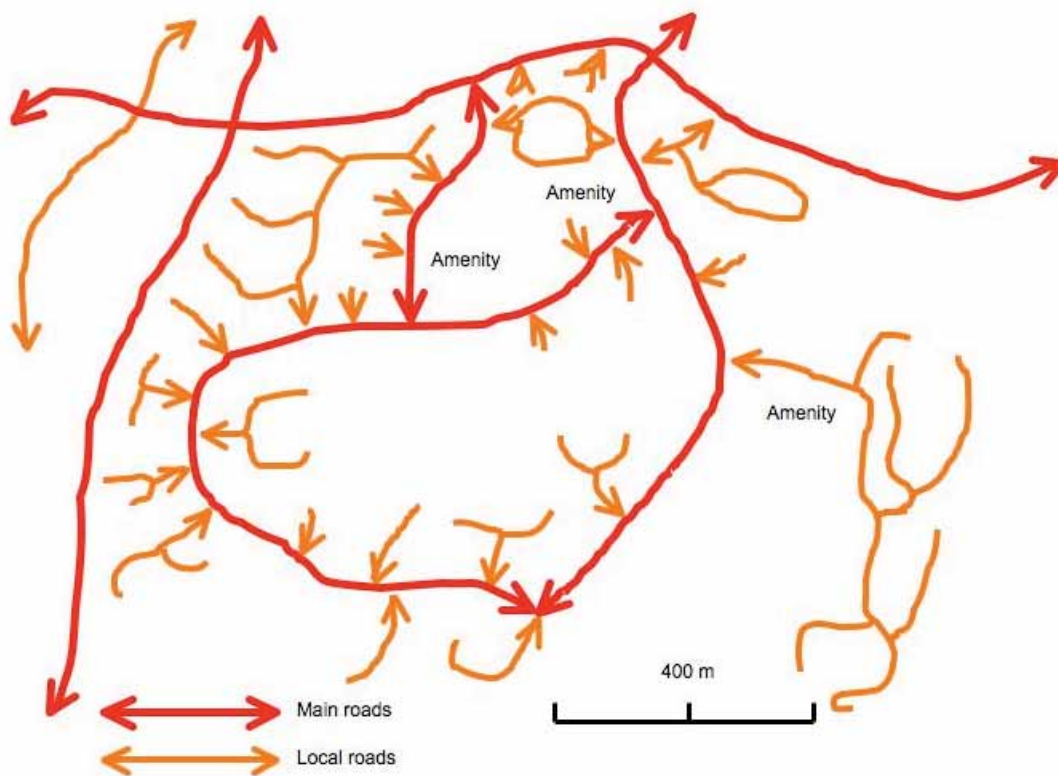


Figure 4.4: Robina Woods road connectivity diagram

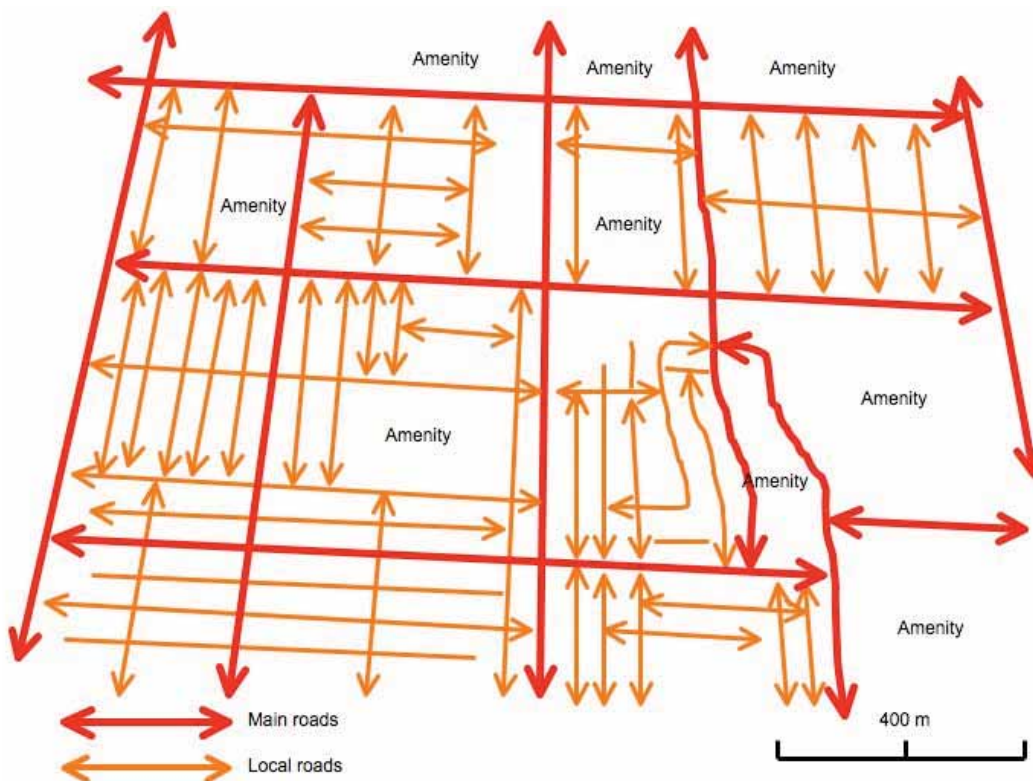


Figure 4.5: A residential suburb of Vancouver's road connectivity diagram

Visually the comparison of the two suburbs is stark. The road connectivity of Robina Woods appears broken and disjointed. The cul-de-sacs of Robina are clearly seen to feed the collector roads, the cul-de-sacs in Vancouver are only found in one smaller area of the south east of the diagram. Permeability of Vancouver is clear with no obvious impediment for route choice to neighbouring suburbs. The local residential roads of Vancouver are contained within the larger grid of the main roads and have intersections and route choice. The local residential roads of Robina Woods have no connectivity to each other and no choice of routes to the south, east, and west.

The amenities of Vancouver are dispersed through the road network and sited to be accessible from the main through routes. This invites neighbouring suburbs to utilise the amenities, and this in turn may also contribute to the vitality and viability of those amenities. This ability to choose destinations within and outside of the neighbourhoods is a significant difference between Robina Woods and Vancouver. The arterial road structure of Robina funnels residents to destinations. Indeed the intent to funnel customers to Robina Town Centre has been identified as a function in the design of the road structure of Robina (Robina Land Corporation, 1999). The question is has choice been removed from the residents of Robina to access their goods, services, recreation and employment? The design of Robina can be seen as centrally controlled and anti free market if viewed in this way.

4.3 Identified barriers to connectivity in Robina

The spatial layout of Robina was examined to establish the main barriers to connectivity for residents. These were identified in mapping of the town as the Grey Barriers of roads (Figure 4.7); the Green Barriers of private open space (Figure 4.12); the Blue Barriers of waterways and lakes (Figure 4.15); the Planned Barriers of land use and streetscape design (Figure 4.16) and the Social Barriers of public and private spaces created by the choices made by developers and residents (Figures 4.17 to 4.26). The following images illustrate and help us understand how the residential suburbs of Robina are separated from each other and the goods, services, employment and amenities they need.

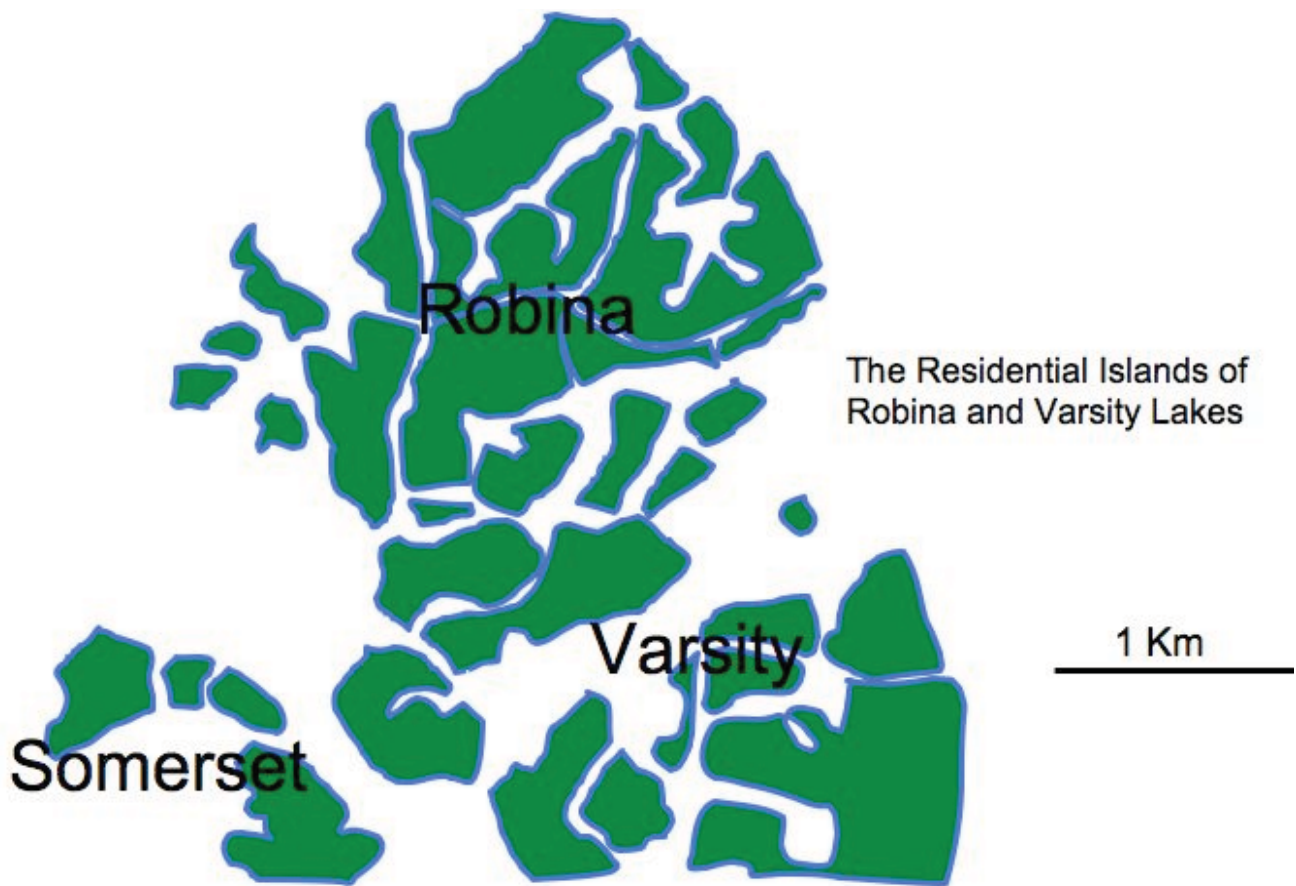


Figure 4.6: The residential suburbs appear as fractured and disconnected islands

4.4 The Grey Barriers

The Arterial road carriageways are up to 27m wide including central median strips up to 13m wide. Roundabouts are large at up to 60m across. There is a lack of safe pedestrian crossings. For instance, there are only two pedestrian controlled crossings along the length of Cheltenham Drive, a sub-arterial road that separates a large Primary School catchment area. For the cyclist and pedestrian there is an obvious car priority, with large shade trees planted on the median strips but not on the pedestrian pathways. Most of the streets only have paths on one side of the street. The paths are also poorly constructed, often with white concrete, which creates too much glare in a sub tropical climate. Paths are often unshaded, poorly lit or unlit at night, with uneven surfaces broken by driveways. Maintenance of the paths is variable and sporadic.

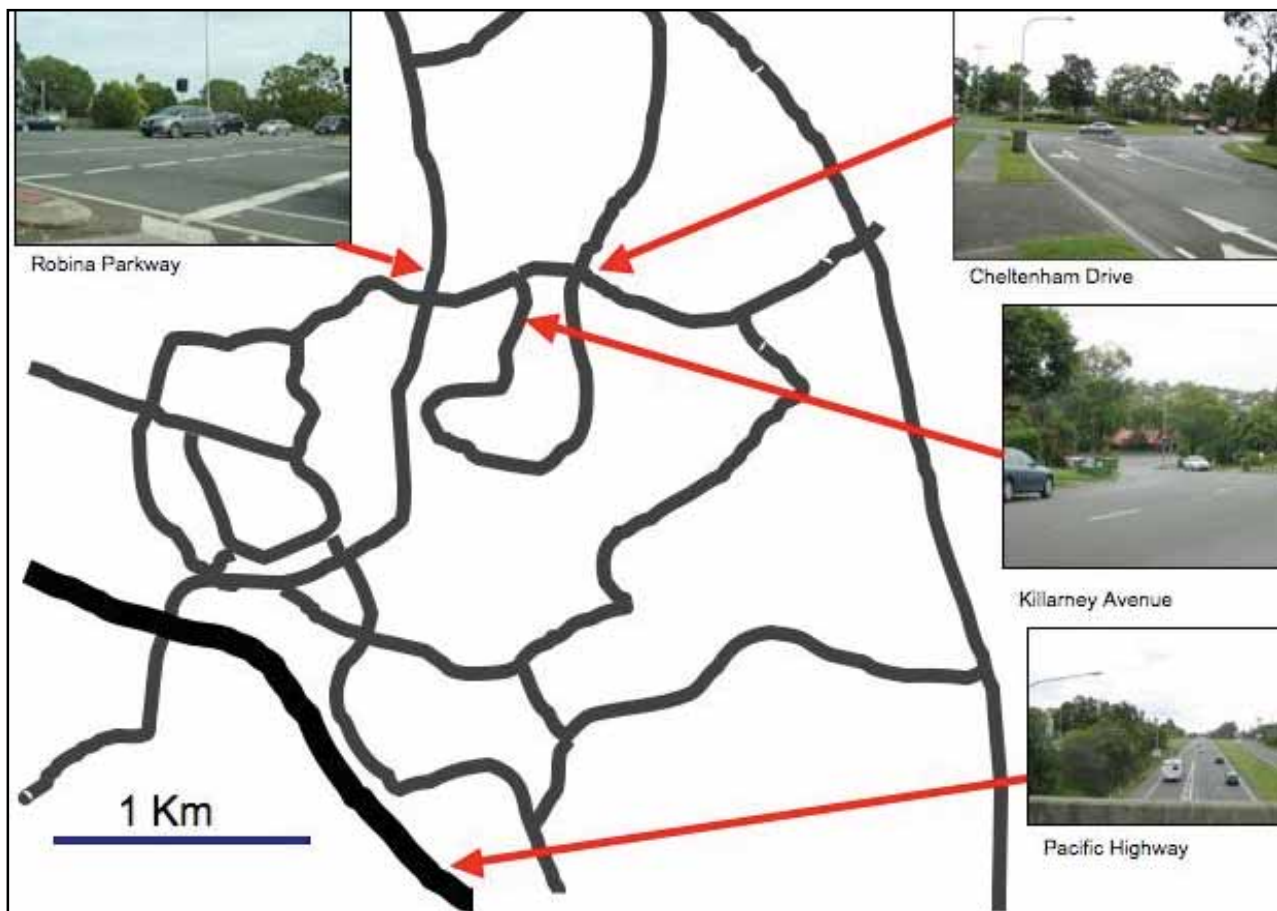


Figure 4.7: The Grey Barriers a hierarchical road network designed for cars

The two main grey barriers for the residents of Robina Woods are Robina Parkway and Cheltenham Drive. These two roads define the northern and western boundaries of Robina Woods. The term 'parkway' means a wide scenic road planted with trees. It is an unusual term in Australia having originated in New York in the design of Central Park. The use of the term in this case is a liberal interpretation as parkways were originally intended to exclude trucks and heavy vehicles (Answers.com, 2008). Robina Parkway is part of an arterial network connecting the Pacific Highway to Gooding Drive and the Nerang Broadbeach Road. Cheltenham Drive and Cottesloe Drive are designated distributor roads in the Gold Coast Planning Scheme (GCPS).

Robina Parkway is a major barrier for pedestrians and effectively blocks, funnels and constrains any pedestrian network from Robina Woods to the town centre and neighbouring residential areas to the west. The speed limit on Robina Parkway is nominally 70 kmh, but in practice this is often observed as over 80 kmh.

The following photographs were taken in a break in the traffic on a Sunday from the only designated pedestrian crossing along the boundary of Robina Woods. They show the crossing, and its access points. Figure 4.8 shows the view from the median strip looking north. This gives some idea of the pedestrian environment. There is no lighting, there is track in the trees but no path along the Parkway on the Robina Woods side, the road itself is split-level, there are fences to the road and there is no public oversight of the pathways except from passing vehicles.



Figure 4.8: A view along Robina Parkway looking north

Figure 4.9 shows the only pedestrian crossing along Robina parkway neighbouring Robina Woods. From kerb to kerb it is approximately 24 metres wide. There is no pedestrian control of the crossing. The speed limit is 70 kmh. The barriers and a small

road sign (on one side of the road only) are the only visual signals for a driver of the presence of a pedestrian crossing. There is no lighting at night.



Figure 4.9: The only pedestrian crossing along the length of Robina Parkway

Figures 4.10 and 4.11 show how the pedestrian crossing on Robina Parkway is accessed from Robina Woods and Robina. These access points to the Robina Parkway crossing are unknown to the majority of Robina Woods' residents. Princeville Court is a steeply sloping cul de sac. There is no lighting on either approach path. The access from Medinde Court is a steep track that is fenced from the houses alongside. There is no clear sense of direction or way finding in either approach to the parkway.



Figure 4.10: The pedestrian access to Robina Parkway from Princeville Court Robina Woods



Figure 4.11: The steep track down towards Medinde Court Robina from Robina Parkway

4.5 The Green Barriers

Golf courses are part of the Planning Strategy of the GCCC with ten golf courses being within a fifteen-minute drive of Broadbeach (Planning Strategy Map PS6). The Robina Woods Golf Course effectively fractures the suburb of Robina Woods and separates Robina Woods from Varsity Lakes. The golf course was opened in 1991 and is ranked as one of the top 30 resort courses in the country. Robina Woods is a 6078 meter, 18 hole, Par 71 championship golf course and occupies 68 hectares (Maxmoment International Internet Application Developers, 2008).

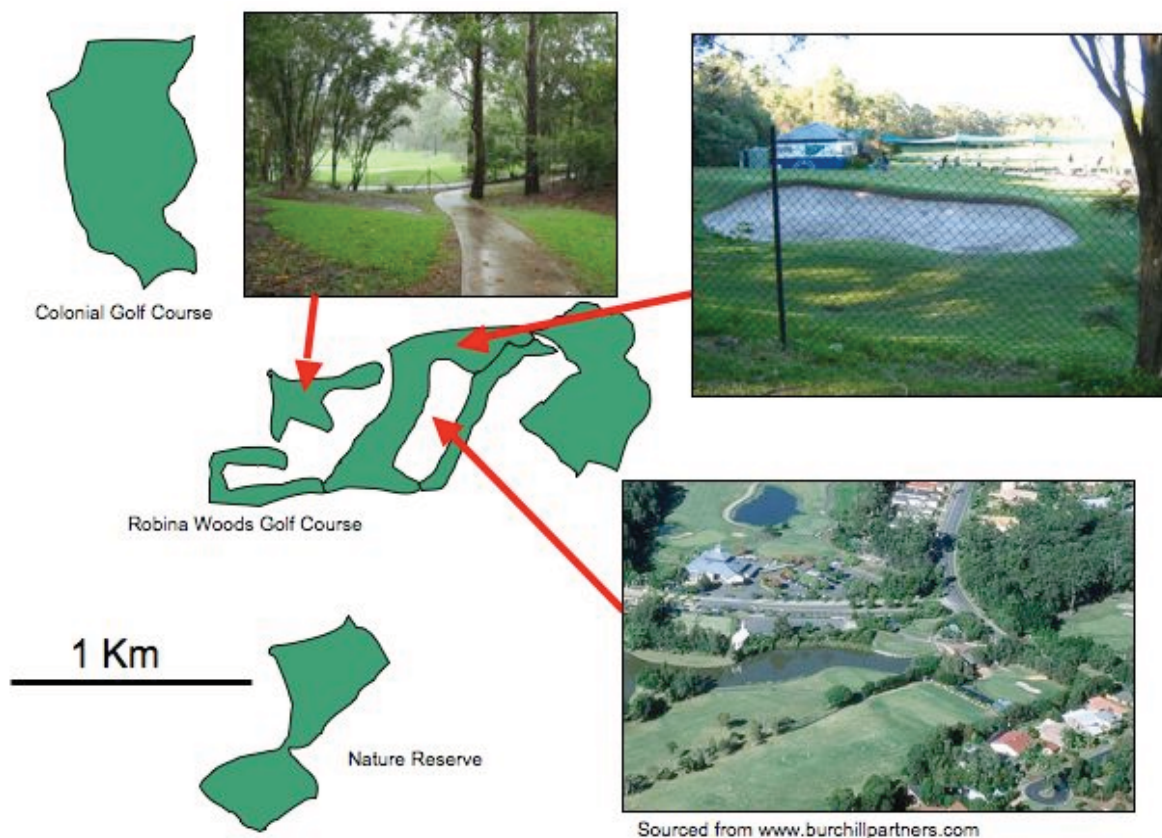


Figure 4.12: The Green Barriers consist of Private open spaces

The meandering course follows the landscaped watercourses. The course is over 2000m by 850m, and surrounds and isolates “The Gallery” residential precinct from all its neighbours in Robina Woods (see figure 4.13). In one particular place, the course is only 33m wide but still manages to separate Robina from Varsity Lakes.



Figure 4.13: Aerial view of Robina Woods Golf Course sourced from its website

This space between the Gallery and Varsity Lakes is taken up with a fenced golf buggy route between holes and was rejected in 2003 as a possible pedestrian/cycle access for students who live in Robina Woods but attend the Varsity College Middle and Senior School in Varsity Lakes¹.

Figure 4.14 shows the northern part of the catchment area for Varsity College Middle and Senior School. The green line is the fenced barrier of the private Golf Course. This indicates the extent of the catchment area affected. It indicates the routes and distances that students who wish to walk and cycle have to go around the Golf Course to get to school.

¹ The author requested consideration of a pedestrian and cyclist link between Robina Woods and Varsity Lakes before the Gallery was built out from the local councilor.

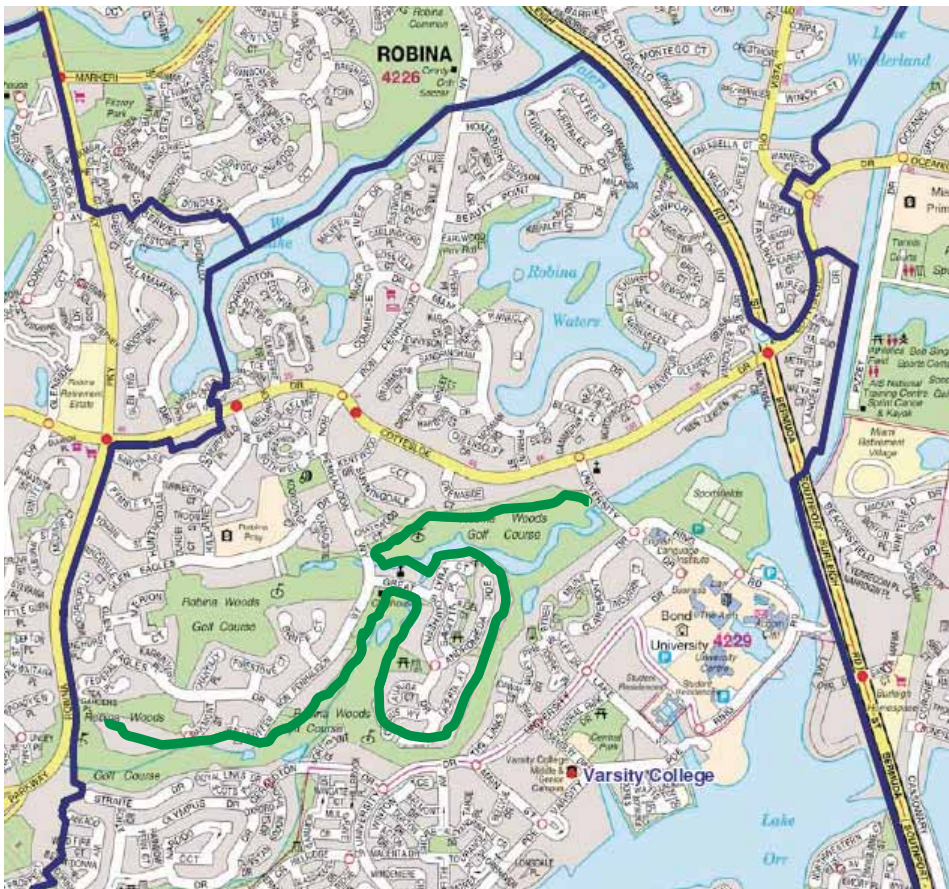


Figure 4.14: The Varsity College Middle and Senior School catchment area, showing the green barrier. sourced from Queensland Education website

4.6 The Blue Barriers

The developers of Robina enlarged existing natural waterways in the construction of the town to create a series of lakes (see figure 4.14). They range from 40 to 500m across and up to 1300m long. It is interesting to note that the narrowest waterways appear to be in Robina Woods Golf Course. The urban form often uses them as moats to isolate pockets of development. They are usually only privately accessible and have little actual amenity for residents without waterside property.

The suburbs of Robina Waters and Robina Quays can be seen to have a fracturing of the urban form caused by the central positioning of the lakes (see Figure 4.14). There is a recognisable similarity in shape and position of the waterways to the role that Robina Woods Golf Course plays in fracturing Robina Woods.

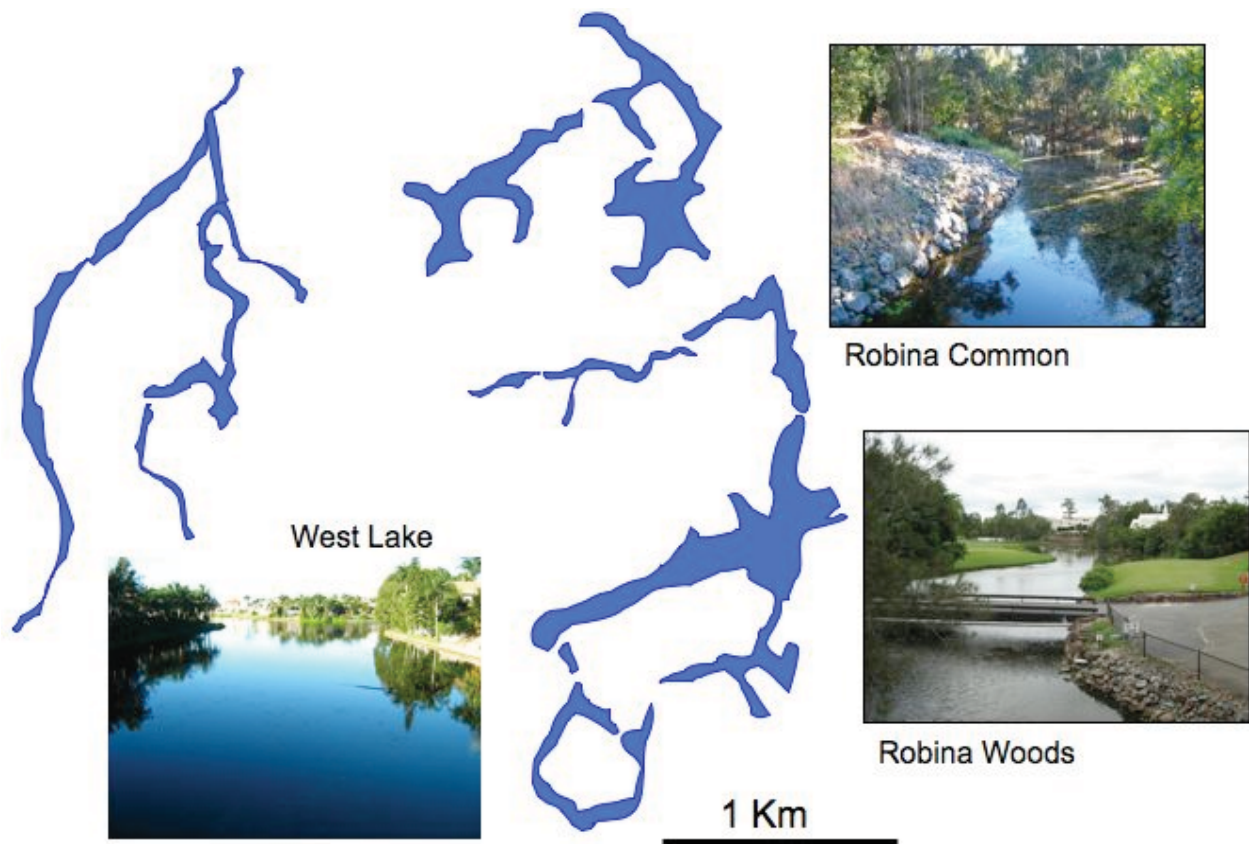


Figure 4.15: The Blue Barrier, the ribbon of lakes and waterways that cut through the suburbs

4.7 The Planned Barriers

The layout of Robina Woods shows the determining influence of the arterial road hierarchy. The majority of residents live in cul-de-sacs. These cul-de-sacs are often physically close to the arterial roads but are fenced and screened off from them (Figure 4.16).

The residents of cul-de-sacs travel by car along the collecting crescents into a limited number of virtual gated entries and exits. These have been indicated on Figure 4.16 with blue circles. These three entries are the only entry and exits points to the suburb for vehicles. There are an extra two pedestrian/cyclist access points on the western boundary of Robina Woods, these access points have been indicated by yellow circles.

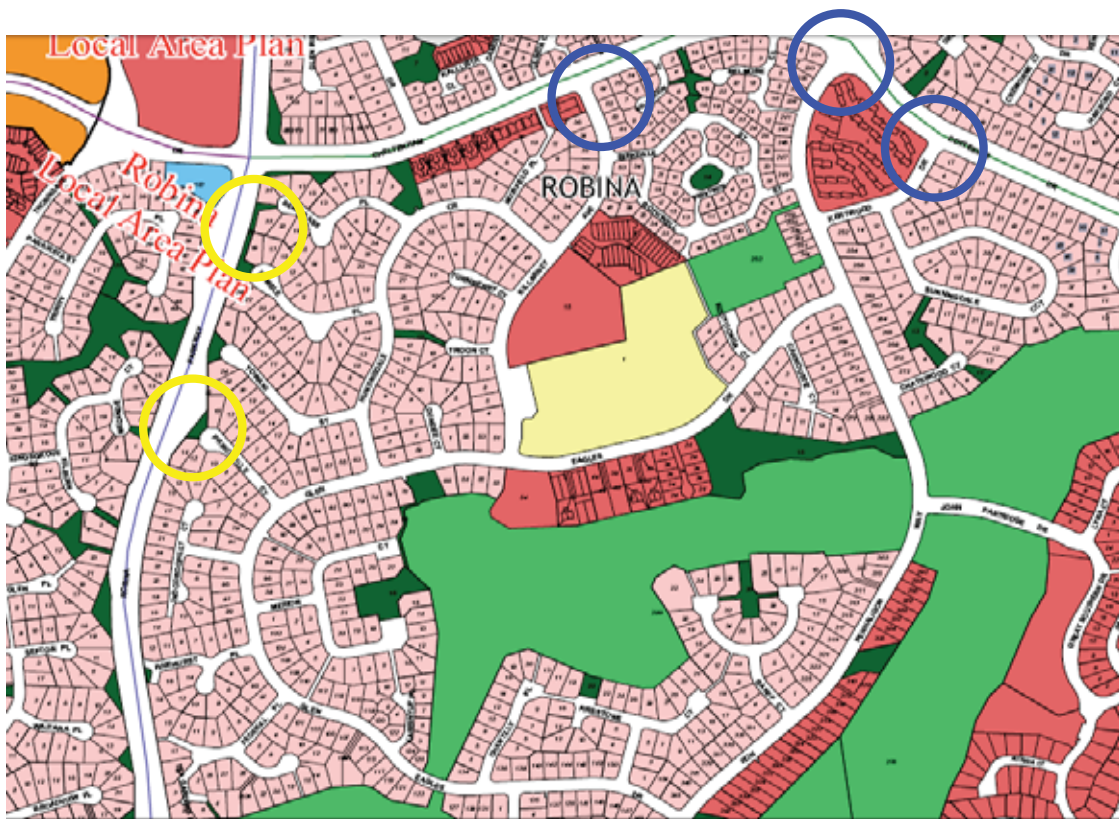


Figure 4.16: The planned barriers of car dependent pockets of residential development with restricted entry and exit points. (Sourced from GCCC PDonline)

The designers intended the creation of exclusive pockets of development that use the green, blue, and planned barriers to separate themselves from arterial roads. The combination of single use residential zones and the urban design features of street layouts, road design, lighting, home frontages and setbacks, single side unshaded paths, and fences to roads combine with planning use restrictions to create low permeability through all of the boundaries of Robina's residential islands.

4.8 The Social Barriers

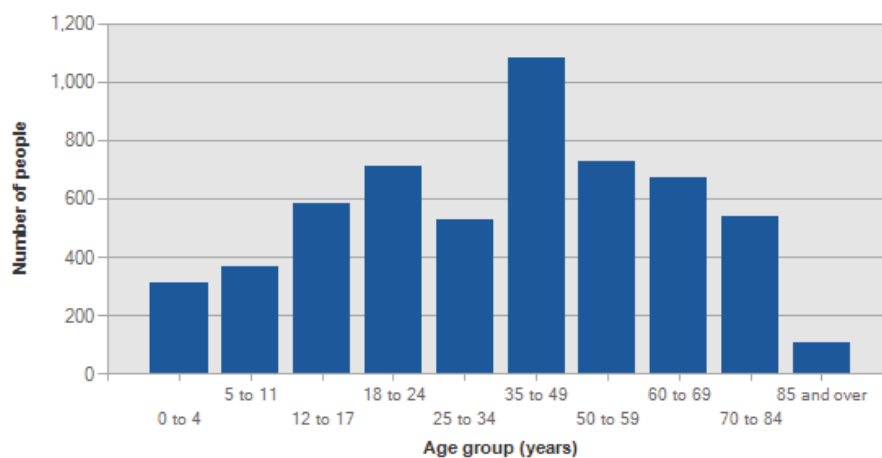
Many factors in the design and construction of homes and streets in the suburb contribute to create poor conditions for the creation of social capital in the residential suburbs of Robina. The low density of less than 12 dwellings per hectare (dph) means that neighbours are not physically close. A typical street may have 8 houses or less in a 100 metre frontage.

There is a lack of local amenities or public meeting places within Robina Woods. There is a noticeable car priority on the streets even in the residential areas as explained in 4.7.3. This, combined with a need to drive to get to most destinations, means that people usually only know their immediate neighbours. A significant proportion of the population is over 55 and under 18 years of age. Local real estate agents report that people who live in Robina would like to stay in Robina. This could lead to an isolated ageing population with a low local social capital.

The SEQRP, which recognises the strong links between urban design and safe, healthy local environments, says one of the objectives of a sustainable community is that they should have *“well-designed activity centres focused around public transport hubs; efficient infrastructure and well-utilised public transport.”* This can be argued to not be the case in Robina. For a neighbourhood of over 3000 people the study area appears to be under-resourced by the principles and policies in section 6 of the SEQRP (Queensland Government, 2005).

4.8.1 Demographics of Robina

The demographics of Robina indicate the suburb as having a large number of households of couples with children. These appear to be made up of parents in their forties and fifties with children in their teens and twenties (see Figure 4.17). There is also a significant group of childless couples.



Source: Australian Bureau of Statistics, 2006 and 2001 Census of Population and Housing (Enumerated)

Figure 4.17: The distribution of age groups in Robina

The Robina Statistical Profile produced by the GCCC gives household income figures that show two peaks at \$15,000 to \$26,000 p.a. and \$52,000 to \$78,000 p.a. The distribution would appear to indicate the area as dominated by mature families. Income levels appear consistent with the Gold Coast median.

The ownership structure of homes in the suburb is equally divided between households that own their home outright, are currently paying a mortgage, or are renting (Gold Coast City Council, 2007). The median sale price in September of 2007 is given as \$513,000 compared to the Gold Coast median sale price of \$466,500. (RP DATA, 2007) Median rentals are reported at \$350 for 3 bedroom units. Property rental and purchase costs are above reported Gold Coast City averages (RP DATA, 2007).

Occupation statistics indicate that the majority of the residents of the suburb are clerical, sales, and service workers or associate professionals. In 2003, a third of Robina residents were born overseas, more than half of these came from mainly English speaking countries.

4.8.2 Pattern and nature of urban development in Robina Woods

There have been two active phases of development in Robina Woods: firstly, the 1980s' "Garden City" parkland style with a garage door frontage brick and tile facade (see Figure 4.18) and secondly, since around 2002 infill has occurred on any vacant blocks in the recently fashionable post-modern, rendered concrete style (see Figure 4.19).



Figure 4.18: 1980s brick and tile homes with a deep setback, driveway, and garage frontages



Figure 4.19: 2000s rendered homes with driveway, and garage frontages



Figure 4.20: An example of a fortified home built in 2008; this is its street face

The newer fortress homes (see Figure 4.20) are characterised by high bare walls, electronic vehicle access, and intercom controlled pedestrian gates, setback private spaces, small, or narrow ground floor windows. Newer homes often have their family living areas at the rear of the home and bedrooms to the front. These features have been progressively introduced as barriers to street access throughout the twenty years of development of Robina Woods. The overall result of this form of development is for homes to separate from and turn their back on the streets they are in.

The suburb also displays examples of a transition from the garden to the fortress style of home. The most recent trend has been for the older homes to be renovated to look like the newer homes with walls being erected to street frontages (see Figure 4.21). This affects the quality of the public realm, with less oversight of streets and public spaces from the homes of the residents who are behind two metre fences.



Figure 4.21: Residents of 1980s homes are gradually erecting fencing to the street

4.8.3 Car primacy in street design

The dominance and extent of the car hierarchy in Robina Woods is described in the following illustrations. The pedestrian and cyclist in Robina continually compete with the car in a residential community. The design of the roads appears to invite cars to travel faster than the speed limits set. The speed limits on the roads are 50 kilometres per hour (kph) within the suburb, 60 kph on Cheltenham and Cottesloe Drives and 70 kph on Robina Parkway. These speed limits often appear to be regularly ignored by cars and other vehicles. Police radar traps are often seen on Cottesloe Drive and have been observed to be very active.



Figure 4.22: The road entrance to The Gallery, Great Southern Drive Robina Woods

Many of the roads within Robina Woods appear to be unnecessarily wide for a residential suburb. This can be seen in figure 4.22. This is the entry road to the Gallery development with the main entry to Robina Woods Golf Course to the right being given its own lane turn.

Considering the low level of traffic to this part of Robina Woods this would appear to be excessive. In comparison, the arterial road roundabout intersection of Ron Penhaligon Way, Cheltenham, and Cottesloe Drives seen in figure 4.23 would be at the same scale. It appears that Great Southern Drive was designed as an entry statement rather than a street.



Figure 4.23: The intersection of Ron Penhaligon Way, Cheltenham, and Cottesloe Drives

4.8.4 Pocket parks, fences, and paths in the public realm of Robina Woods

A noted feature of the urban design of Robina Woods is the pocket parks and paths. These are cited as an example of the green credentials of sustainable design in Robina. The current quote from the CBD Robina website is: *Well planned streets and pedestrian areas, a generous provision of parks, lakes, paths and sports fields, safety and security, the promotion of high building standards* (CBD Robina, 2008).



Figure 4.24: A connecting path, fenced off, unlit, poorly made, and constructed.

The problem with this statement is that the parks only appear to be the developers' method of reaching planning requirements for open public space. Figure 4.26 shows the pocket parks in dark green. The pocket parks are not obviously a network and they often have little or no practical amenity. They are sometimes difficult to access and on steep slopes (see Figure 4.25). They do not provide a community focus and are often fenced off by residents who see them as a security risk rather than a visual amenity (see Figure 4.26)



Figure 4.25: Well planned streets and pedestrian areas?



Figure 4.26: The fencing of homes from street and adjacent parks

4.8.5 A decrease in density and household size

The first precinct built in Robina Woods was in the North adjacent to Cheltenham Drive. The approximate housing density here is about 12 dph. The Southern Precinct built in the mid to late 1980's has around 7.5 dph and the recently built Gallery about 5.25 dph. These figures alone indicate that homes in the suburb are getting larger whilst the household size, which has fallen to 2.7 persons per dwelling is falling in line with national trends (Department of Family and Community Services, 2000). These figures reinforce the impression of a society seeking to create privacy in their homes above community in their streets.

4.9 Combining the barriers

The previous pages describe the physical and social barriers to urban connectivity that exists in Robina. In and of themselves each one can be rationalised and excused. The cumulative effects of the combined barriers is, however, a complex and significant problem for the physical and mental health of the residents (Australian Local Government Association et al., 2008) page 22.

The causes of the extent of disconnect evident in the urban structure of the Robina Residential Archipelago can be seen in Figure 4.27. The residents of Robina live in the isolated pockets created by the physical barriers. This has been exacerbated by the urban design of the streets and homes within the residential pockets.

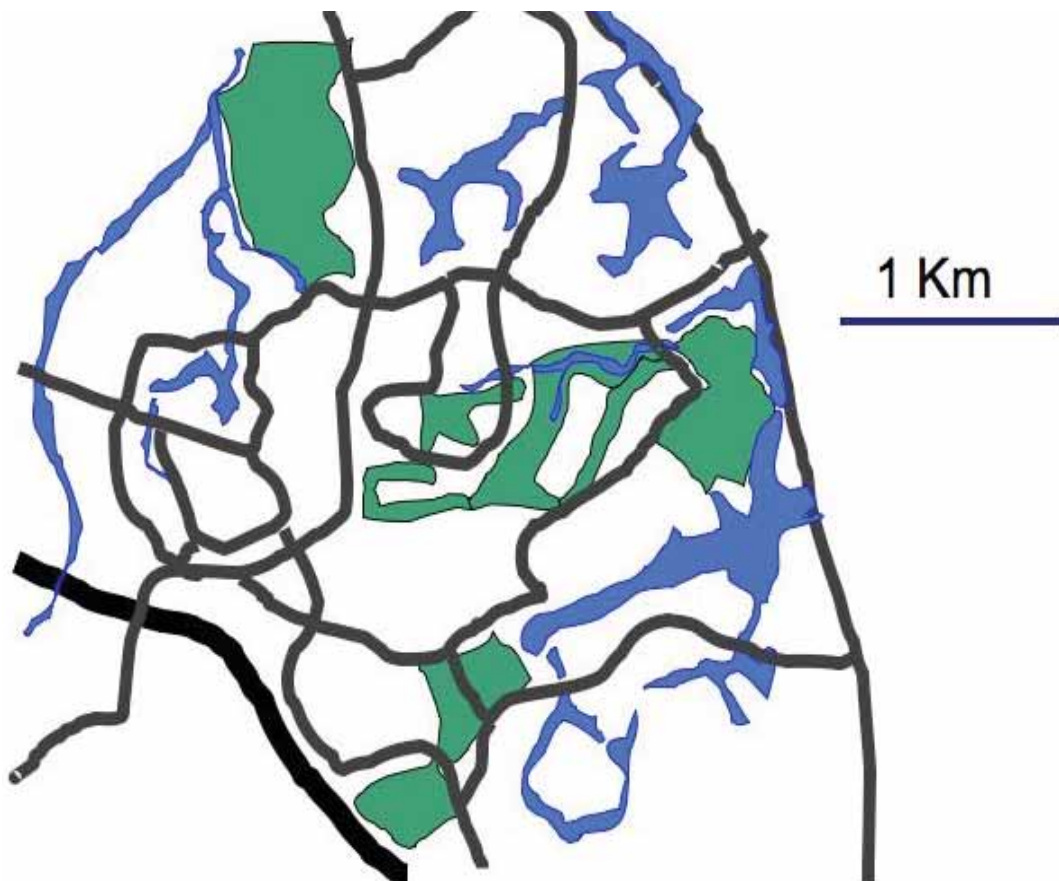


Figure 4.27: The combination of the barriers creates the disconnected urban form that is the Robina Residential Archipelago.

4.10 Non-residential land uses in Robina and Varsity Lakes

In the previous illustrations the disconnected urban form is clearly articulated. To further understand how the separate land uses affect the residents of Robina the following illustrations show the location of local sources of goods, services and employment relative to the homes of the residents.

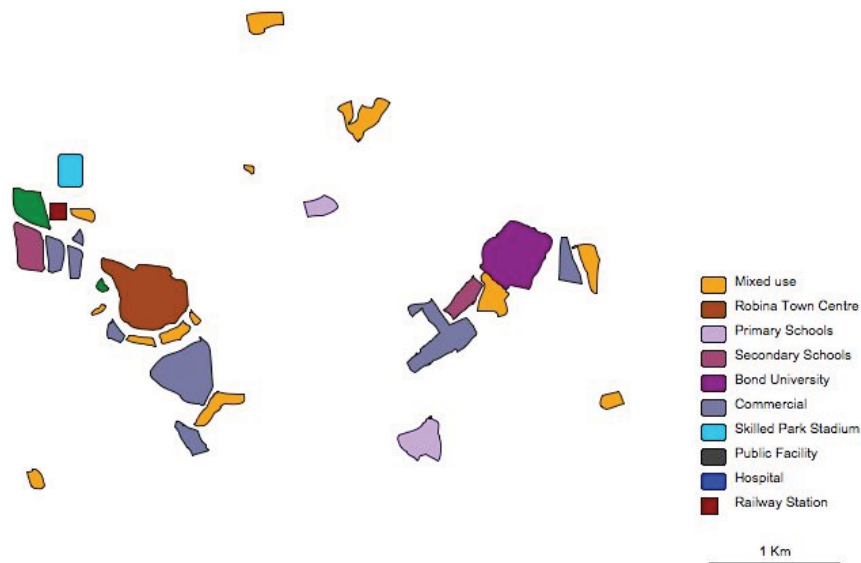


Figure 4.28: The spatial relationship of non-residential land uses in Robina

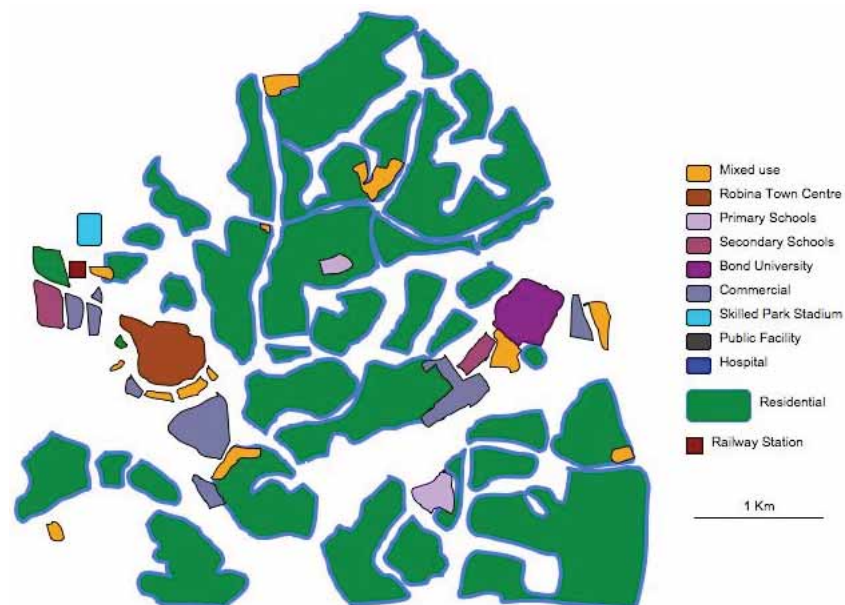


Figure 4.29: Robina has its service centres on the outside of a fragmented residential “core”

Figures 4.28 and 4.29 illustrate the inside-out nature of development in Robina, with the destinations on the edges of the residential core. The goods, services and employment are also in their own archipelago configuration disconnected from the residents they serve.

4.11 The extent of car dependency in Robina

The residential suburbs of Robina have a high degree of car dependency. Very few residents are within walking distance of their, work, education, goods, services or employment. Public transport is currently seen as unable to provide a frequent, reliable or connected service. This is in large part due to the low residential density of the suburbs. These have been estimated as varying from 5.75 to 14 dph.

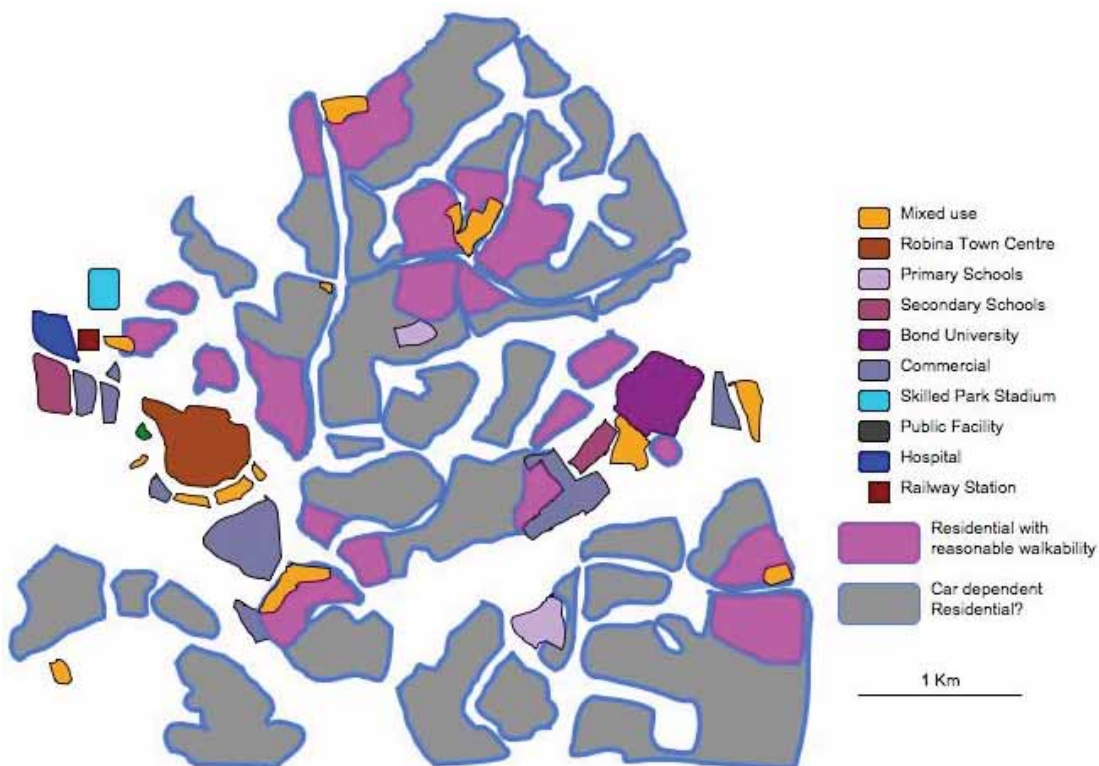


Figure 4.30: The illustrated extent of suspected high car dependency in Robina

Figure 4.30 is an attempt to map the suspected areas of high car dependency in Robina. It also illustrates the spatial distribution and dominant extent in the urban form of car dependency.

5.0 Mapping the walkability of Robina Woods

Mapping was chosen as the primary method of measuring the walkability of the chosen study area. The ped shed pattern maps presented in Section 6.0 illustrate the degree of walkability found for residents in Robina Woods. They show the distances that were achievable in a five, ten and twenty minute walk by a reasonably fit person. They disregard the actual terrain, traffic on the arterial roads, condition or legibility of paths, and the sub tropical climate. They can only be considered to be indicative of how far it is possible to walk in the time available.

The ped shed maps, Figures 6.1 – 6.10, are intended to examine how many destinations are possible from each selected residence and how the spatial layout of streets and paths affect residents' ability to reach destinations. The colours chosen to represent the probable distance covered by a pedestrian on each of the pedestrian pattern maps is:

- **Red lines** represent 375M from the residence or 5 minutes travel time
- **Orange lines** represent 750M from the residence or 10 minutes travel time
- **Yellow lines** represent 1500M from the residence or 20 minutes travel time

5.1 Mapping the road connectivity of Robina Woods

The Road Deviation Index maps, Figures 6.11 – 6.20, are an analysis of the distance by road and in a straight line from each of the selected destinations to each of the selected residences in the Robina Woods study area. A calculation was made of the variation of travel distance in a straight line and the actual traveling distance by subtracting the straight-line distance from the actual distance. This has been termed the 'variance'. The variance can be used to estimate the costs of extra travel for residents caused by spatial layout of the urban form.

From these figures it is also possible to give an indication of the distortion caused by the spatial layout and barriers of the urban form as a numerical percentage. Dividing the actual road distance by the straight-line distance and multiplying by 100 creates an answer expressed as a percentage of the straight-line distance. This percentage can be used as an index of the distortion caused by the design of the road network. This distortion is called the Road Deviation Index in the text.

5.2 The accuracy of the collected data

The data produced from the analysis is presented with known limitations. The base maps used were scaled and checked against distances measured on Google Earth and the GCCC PDOnline database of Gold Coast properties. However, the method used to calculate walk and road travel distances was to use string to measure along the roads on the map. This is acknowledged to be subject to inaccuracies but it is still seen as a useful method that produces a more accurate picture of the pedestrian shed than drawing a circle on the map.

A difficulty in measuring the accuracy of travel distances and times was the actual pedestrian ability to negotiate the measured distances in the time available. The roads in the case study area especially Robina Parkway, Cheltenham and Cottesloe Drives can be very variable in the actual time it takes to cross them, either at pedestrian crossings or otherwise. The time taken to cross these roads depends on traffic conditions and traffic light timings.

Another factor affecting accuracy of the findings is that the slope and terrain could not be accounted for. Slopes in Robina Woods can be steep and the pathways not well made or clearly defined (see figures 4.24 and 4.25). However, the effect of possible inaccuracies of the maps is seen as likely to be overestimating the distance that pedestrians can travel in the time available. Considering these factors the findings are seen as understated and likely to be conservative.

5.3 The effect of Robina Parkway on local walkability

The walkability indicated on the pedestrian maps to the west of Robina Parkway is considered possible but unlikely in its penetration of the local street pattern. Many residents would either not know about, be able to navigate or use the routes that were mapped. This is especially true at night as there is no lighting on the paths or at the crossing (see figures 4.10 and 4.11). The difficulties that residents will encounter at the pedestrian crossing at Princeville Court on Robina Parkway (see figures) of lighting, safety and pedestrian path usability are also described in Section 4.0.

The crossing at the intersection of Robina Parkway and Cheltenham Drive (see figure 5.1) is subject to the traffic light sequence and has been observed to be the site of frequent vehicle collisions. These appear to be due to poor visibility at the junction and the high approach speeds of cars along Robina Parkway.



Figure 5.1: Aerial view of Robina Parkway and Cheltenham Drive intersection
Image from Google Earth

5.4 The effect of Cheltenham and Cottesloe Drives on local walkability

The walkability north of Cheltenham Drive is subject to the pedestrians' ability to actually cross the road. Waiting times at the three pedestrian crossings along Cheltenham and Cottesloe Drives affect the permeability of the road for pedestrians. The roundabout and median strips offer limited accessibility for anyone who is slow to cross a road as the highway has four lanes; the traffic is fast and frequent at most times of the day. There are only two pedestrian controlled crossings along the 1020 metre length of Cheltenham and Cottesloe Drives where they border Robina Woods.

The crossing point on the Cheltenham/Cottesloe Drive roundabout intersection with Ron Penhali-gon Way (see figure 5.2) is difficult to cross safely as vehicles can enter and exit the roundabout at some speed. The roundabout is over 60 metres across with two traffic lanes. It is difficult for pedestrians to judge the presence, directional intent and speed of vehicles on each of the entries to the roundabout.



Figure 5.2: Aerial view of Ron Penhaligon Way and Cheltenham Drive Roundabout
Image from Google Earth

A pedestrian demand traffic light was installed recently on nearby Cottesloe Drive as a “National Black Spot” initiative. The roundabout has curving approaches with screening plantings on the median strip. This can restrict the drivers’ viewpoint as they approach and exit the roundabout. The entry from Cottesloe Drive on the east has a significant hill causing traffic to suddenly appear to a pedestrian attempting to cross Cheltenham Drive on the west of the roundabout.

Crossings the road at any other points along Cheltenham or Cottesloe Drives would be probably unsafe or unrealistic. Elderly residents with slow walk speeds and younger children would be most likely to be affected. The design of the roads with their curves and median strip plantings can be seen to affect residents of any age wishing to cross the roads. However, statistics would seem to point to the vulnerability of younger and older residents in pedestrian accidents (Trentacoste, 1999) .

5.5 Analysis of the collected Data

An analysis of the tables presented in section six suggests that residents of Robina Woods are affected in different ways by their geographical position within the suburb, their proximity to the identified physical barriers and the spatial layout of the road network. When examining the maps similarities were distinguished in groups of residences. It is recognised that the samples are small and the way the data is presented was subsequently reorganized to reflect these findings.

5.6 Analysis of the ped shed maps

The analysis of the ped shed maps show that residences within Robina Woods can be grouped according to similarities in the their shape and level of penetration of the local street structure evident in their ped shed maps.

These groups share the same constraints and impediments to walkability:

- The northern residences 1 and 2 are close to major crossroads and have a reasonably deep penetration of the surrounding urban form.
- The western residences 3, 4 and 5 are constrained by Robina Parkway and the central section of the Golf Course.
- The southern and eastern residences 6, 7, 8, 9 and 10 are mostly constrained by their relationship to the golf course that encloses them in varying degrees.

The residents of Robina Woods can be seen to have very poor ability to reach destinations either in or outside of their suburb. Table 5.1 shows only one residence at the northern entry to the suburb can reach four destinations in a 10-minute walk and this is constrained by the ability to cross the roundabout intersection of Ron Penhaligon Way and Cheltenham Drive (see figure 5.2). Six residences can only reach 1 destination and one residence cannot reach any destinations in 10 minutes. In light of the fact that a 10-minute walk is a maximum walking range for many months in the sub tropical climate, the results for walkability in Table 5.1 illustrate that the residents have few options and few destinations either inside or just outside their neighbourhood to maintain motivation to walk rather than use a car (US Transportation Research Board, 2005 cited in (Australian Local Government Association et al., 2008)).

Table 5.1: Destinations reached in 5, 10 and 20 minutes walk from selected residences

Positional constraints or advantage	Residence	The number of destinations reached out of a possible 10 in:		
		5 minutes	10 minutes	20 minutes
Constrained by 4 lane highways, fences and slopes. Adjacent to major crossroad.	1	1	0	4
	2	2	2	3
Constrained by Robina Parkway, part of the golf course central to the suburb, cul de sacs and steep slopes.	3	0	1	2
	4	1	1	4
	5	1	0	4
Constrained by position within golf course area, steep slopes, cul de sacs and distance from the suburb entries and exits on the northern border	6	0	0	2
	7	1	2	3
	8	0	1	2
	9	1	0	3
	10	0	1	2

A key motivator for regular physical activity is seen as a variety of local destinations within five to ten minutes of the home (Duncan & Mummary, 2004 cited in (Australian Local Government Association et al., 2008)). The urban design compendium by English Partnerships (Llewellyn Davies, 2007) states that the success of a town or new development lies in the sense of place created by the pedestrian environment, where connections give people the maximum choice in how to make their journeys with a presumption in favour of walking, cycling and public transport.

5.7 Analysis of the Robina Woods RDI maps

The Road Deviation Index maps indicate the distance and routes from each of the selected destinations to all ten of the selected residences in the study area. The tables show the measured straight-line distance from the chosen destination to each of the residences, the on road distance that vehicles must travel by the shortest available road route and the variance between the two distances. This variance can be seen as the excess road travel incurred by residents directly caused by the fractured and disconnected road system. These tables were used to calculate an aggregated median average of the RDI for the destination to the selected residences in Robina Woods.

The importance of these maps is emphasised by the estimates that 58 per cent of all car journeys are less than five kilometres and 33 per cent are less than three kilometres (Australian Local Gov-

ernment Association et al., 2008). Residents of Robina Woods who wish to travel to the east, west and south of their suburbs are additionally disadvantaged for the time and distance it takes to reach local destinations over other residents who live within a more connected road network.

Table 5.2: Excess road travel to selected destinations from residences in Robina Woods

Geographical Position	Destination	Variance over straight line distance for journey to all ten residences in m	Mean Average excess for all ten residences in m
North	E	2940	3365
	F	3790	
South	H	17165	30295
	J	13130	
East	K	6835	15147
West	A	19448	54974
	B	90500	
Interior	C	4010	3670
	D	3645	
	G	3355	

These results would tend to confirm the view that the worst barriers to permeability for the suburb are to the west with the Robina Parkway, to the south and east with the golf course. The variation within the suburb and to the north would appear to be affected to a lesser extent by the golf course and the spatial layout of the streets. This suggests that the hierarchical road network does channel residents to the northern exits.

The residences are similarly affected by their proximity to barriers and the nature of the road network as it emanates from the residence. The residences within Robina Woods that would appear to be similar are: 1 and 3 against fences and the parkway; 4, 5 and 7 as geographically central; 6 and 8 affected by the parkway and the golf course; 9 and 10 within the Gallery subdivision; and 2 as the only residence with direct road access to a major road intersection.

As well as indicating the excess travel distances that residents are forced to travel from their homes to destinations, the RDI maps can be used in other ways:

- The index can be used to estimate the probable excess costs of extra travel distance
- The index could be used to determine an optimal position for the siting of facilities and amenities for residents
- The index could be used to consider improvements to existing road structures and determine best possible road networks

Before this can be done it is necessary to decide on a base point for acceptable levels of RDI. This would require extensive modeling and testing which is outside of the scope of this case study. A proposed model based on comparison of the Robina Woods study to a small comparative area in a city with a grid road structure was considered a starting point.

5.8 Comparison to RDI of a selected Vancouver suburb

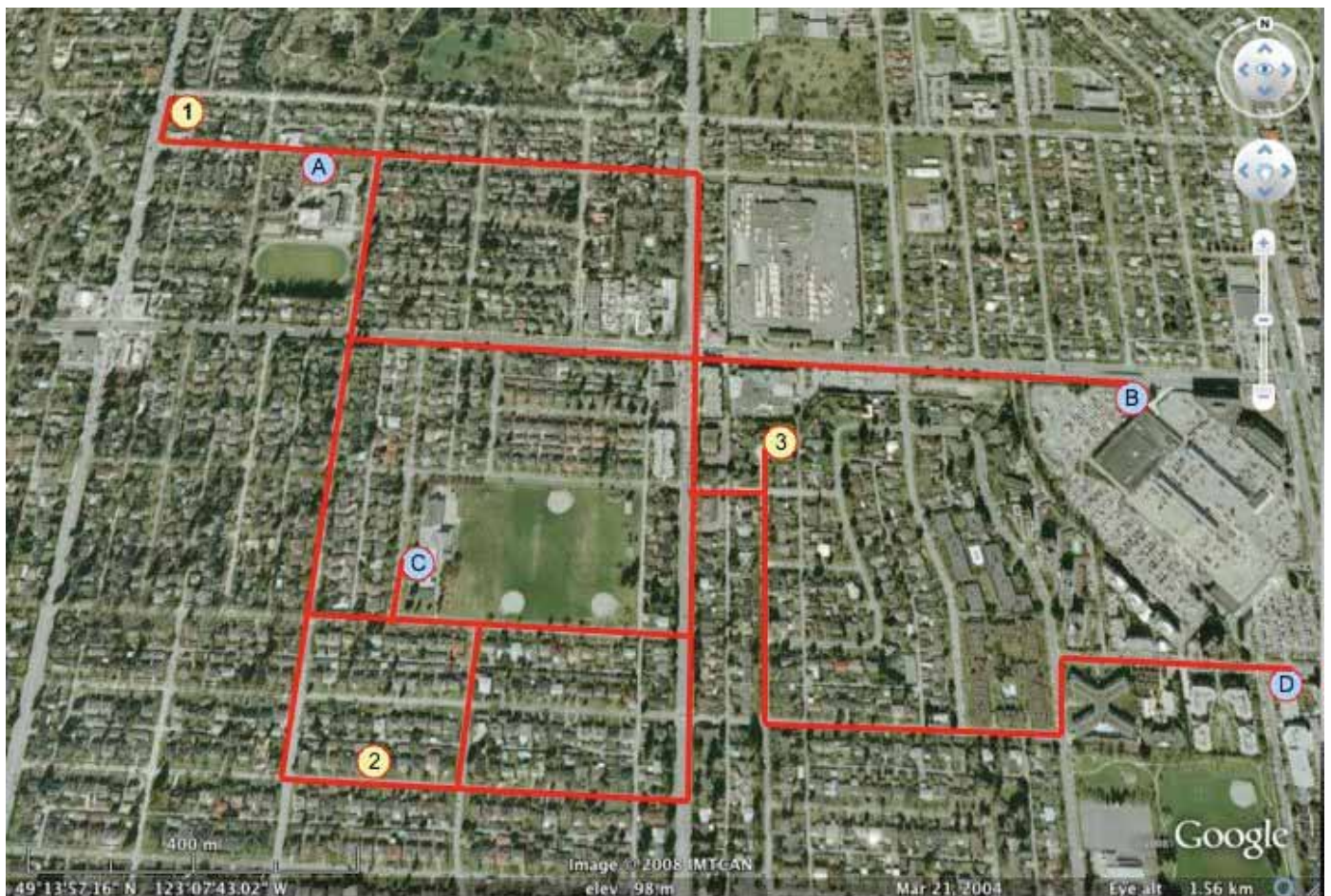


Figure 5.3: Map of residences and destinations used to calculate comparative RDI

In order to get some perspective of the RDI results for Robina Woods, a smaller analysis was made of the Vancouver suburb used as a comparison for the road connectivity diagrams (figures

4.4 and 4.5). Three residences and four destinations were selected to give a comparative RDI for Vancouver to use in examining the results obtained in Robina Woods. The residences were selected to be as representative as possible for a small sample on the following criteria:

- Residence 1 is on an intersection and in the northwest of the study area
- Residence 2 is mid block on a large block pattern in the south of the study area
- Residence 2 is centrally situated and one of the few cul de sacs of the study area

The destinations were selected to be as representative and difficult to reach as was possible, to be as useful for comparison to the Robina Woods sample. There were no destinations that could be considered as isolated by major spatial barriers as in Robina Woods. The reasons for selecting each destination were:

- Destination A is the high school and in a corner of the study area
- Destination B is an 8 block development at the edge of the study area
- Destination C has a large 3 block green space adjacent and is central to the study area
- Destination D was selected as it is adjacent to a large shopping centre which disrupts the grid pattern on the edge of the study area

5.9 Analysis of the comparative RDI results

The results of the study in Vancouver give a remarkably low range of results with RDIs of 134.2 to 140.1(see table 5.3). Given that the grid structure is the recommended spatial model for mobility networks for pedestrians and vehicles alike (Llewellyn Davies, 2007), the results from Vancouver could be used as a base point in the calculation of the extra costs incurred by residents of Robina Woods in time, vehicle running costs and excess fuel consumption.

Table 5.3: Comparative RDI results for Vancouver suburb

Vehicle journey distances originating from destination A			
Residence	Straight line distance m	Road route distance m	Variation m
1	256	350	94
2	903	1110	207
3	836	1218	382
Totals	1995	2678	683
Mean Average RDI for destination A 134.2			
Vehicle journey distances originating from destination B			
1	1533	1873	340
2	1171	1643	472
3	530	1015	485
Totals	3234	4531	1297
Mean Average RDI for destination B 140.1			
Vehicle journey distances originating from destination C			
1	828	1123	295
2	301	526	225
3	523	630	107
Totals	1652	2279	627
Mean Average RDI for destination C 137.9			
Vehicle journey distances originating from destination D			
1	1806	2542	736
2	1170	1344	174
3	710	1129	419
Totals	3685	5015	1329
Mean Average RDI for destination D 136			

5.10 A proposed model for using the RDI scores

The low variance in the range of results for the comparative RDIs in Vancouver suggest an optimal baseline range of the RDI to be 130 for the street grid. There were, however, lower results in the curvilinear road structure of Robina Woods. Based on both sets of results the author proposes a six star scale (table 5.4). This could be used to assess the contribution road structures can make to urban connectivity.

Table 5.4: Proposed RDI star rating scale

RDI range	RDI range	RDI range	RDI range	RDI range	RDI range
100 to 124	125 to 149	150 to 174	175 to 199	200 to 224	225 to 250
Five Star	Four Star	Three Star	Two Star	One Star	No rating

The advantage of a star rating is that it is easily understood, and can be used to raise standards. For instance, if suburbs were rated for their RDI, residents could use the index in determining where to live. This in turn puts pressure on developers and providers of goods, services, amenities and employment to raise their level of commitment to connected places.

The rating descriptors of the individual star rating are:

- **Five Star:** excellent urban connectivity by the road system
- **Four Star:** very good urban connectivity by the road system
- **Three Star:** good urban connectivity by the road system
- **Two Star:** poor urban connectivity by the road system
- **One Star:** very poor urban connectivity by the road system
- **No Rating:** extremely poor urban connectivity by the road system

This rating system needs to be understood in terms of the road system only and could not be taken as an indication of the urban quality of the streets nor the ease of access for cyclists and pedestrians who need a safe and legible route as much as a direct route to destinations.

This star rating is only a preliminary suggestion and would need to be examined, critiqued and tested against a range of scenarios to refine it. In applying it in its current form to the Robina Woods study we get the following results (table 5.5).

Table 5.5: Star ratings for destinations from Robina Woods

Geographical Position	Destination	Road Deviation Index RDI result	Star Ratings	
North	E	127.7	4	4
	F	129.2	4	
South	H	222.6	No rating	1
	J	178.8	2	
East	K	138.5	4	4
West	A	238.6	No rating	1
	B	204.5	1	
Interior	C	172.6	3	3
	D	152.2	3	
	G	143.7	4	

The results in table 5.5 indicate that the scale may be too lenient and may also need to be a logarithmic rather than an arithmetic scale. Even allowing for this, the scale in its current form gives some interesting results that would probably be true even after refinement of the scale. The results indicate that:

- Destination H, Varsity College has an extremely poor result that needs to be rectified considering its importance to the Robina Woods community.
- Destination J, Market Square Varsity Lakes has a poor result that indicates that it is not realising its market potential as a neighbourhood centre.
- The suburb of Varsity Lakes is extremely disconnected by road for pedestrians and cyclists and very inefficiently connected to Robina Woods.
- Destination A, Robina Town Centre has an extremely poor result. This is very significant for residents of Robina Woods as it is the primary, local destination. It cannot be practically reached on foot; it is very difficult and unsafe for cyclists to get to. It is also an extremely inefficient destination for motorists and probably causing a significant extra cost to any residents who have cause to go there regularly.
- Destination B, Robina Parkway Medical Centre has a very poor result. This is very significant as it can be assumed that the sick, disabled, young and the elderly who need to use it

will find it difficult to access. It is further disadvantaged by its proximity to Robina Parkway and can only practically be reached by vehicle.

- The town centre area west of Robina Woods has very poor urban road connectivity. This is significant due to the very high level of importance this area has for residents. Major destinations to the west include Robina State School, Robina Railway Station, Robina Hospital, Skilled Park and the Pacific Highway. The inefficiency of this road connection is likely to be currently causing very high, ongoing externalized costs to residents.
- Destination C, Robina State School has a good urban connectivity rating, however it is lower than could be expected considering its geographical position near the centre of the suburb. This is almost certainly limited by the proximity and spatial shape of the golf course. This is also probably true of destinations D and G.
- Destinations E and F, have very good results that are better than the Vancouver comparison. This is thought to be a function of the curvilinear tree structure of the cul de sacs and crescents that direct and channel traffic to the entry and exit points. Both destinations benefit from their proximity to the Ron Penhaligon Way exit from the suburb. This is a logical result as curves can be closer to straight-line connections than rectangular grids. Destination K also seems to bear this observation out.
- The results for the northern and eastern destinations is significant in suggesting that development of facilities and amenities close to the exits of the suburbs may be beneficial to residents of Robina Woods, Robina Quays and Robina Waters. They also invite further investigation of the concept of curvilinear grid road structures.

5.11 Impacts of the inefficient road design for Robina Woods residents.

The results from the initial survey of Robina Woods indicated that residents are traveling further and as a result paying more to run and fuel their cars than if they lived in a more connected place. The distances that residents have to travel to reach the goods, services and employment destinations from their homes were calculated to give an estimate of the impact on household budgets

These calculations on table 5.6 can be used to calculate the current externalized costs borne by residents of Robina Woods as a direct result of living in a disconnected urban form. They are based on total running costs per km and litres per 100 km. These were sourced from Royal Automobile Club of Queensland magazine “the Road Ahead” October 2008 edition (Green, 2008).

Table 5.6: Private vehicle ownership costs from the RACQ October 2008

PRIVATE VEHICLE OWNERSHIP COSTS						
(Standing costs shown in average \$ per week; running costs in average cents per kilometre.)						
	Honda Civic (Hybrid)	Honda Civic VTI (Petrol)	Hyundai i30 SX (Petrol)	Hyundai i30 SX T/dsl (Diesel)	Ford FG Falcon XT (Petrol)	Ford FG Falcon XT (LPG)
	1.3 CVT Sedan 4.6 litres/100 km \$32,990	1.8 Auto Sedan 7.2 litres/100 km \$23,790	2.0 Auto 5dr Hatch 7.6 litres/100 km \$20,990	1.6 Auto 5dr Hatch 6.0 litres/100 km \$23,490	4.0 Auto Sedan 10.5 litres/100 km \$36,490	4.0 Auto Sedan 15.0 litres/100 km \$37,890
STANDING COSTS (av. \$/week)						
Depreciation	77.84	60.58	57.09	62.78	112.99	113.10
Loan interest	42.54	31.83	28.45	31.47	47.51	48.03
Registration, Insurance, Licence, RACQ Membership	25.37	25.37	22.56	22.56	24.36	24.36
RUNNING COSTS (av. c./km)						
Fuel	7.83	10.54	10.54	8.00	15.37	10.13
Tyres	0.97	0.97	0.76	0.76	0.88	0.88
Servicing, repairs	6.29	5.19	5.01	5.15	4.23	4.50
TOTAL COSTS						
Av. c./km	65.63	57.53	53.78	54.41	84.57	79.81
Av. \$/week	189.31	165.95	155.15	156.95	243.95	230.21
Annual Cost	\$9844.03	\$8629.62	\$8067.55	\$8161.63	\$12,685.22	\$11,970.89
<p>NOTE: Fuel costs were calculated using 146.4c ULP, 154c PULP, 170.30c diesel and 67.5c LPG (cents per litre), based on the average price in Brisbane for the last week of May. Consumption data was based on Australian Design Rule 81/01.</p> <p>Maintenance costs include servicing according to the manufacturer's schedule, plus repairs and spare parts likely to be required. A labour rate of \$113 per hour including GST has been used.</p> <p>* For further details of other criteria used, or for Facts on Private Vehicle Expenses, contact the RACQ Technical Advisory service on 3666 9148 or visit racq.com.</p>						

The costs from figure 5.6 were utilised and adapted to estimate the weekly extra costs of travel for the ten selected residences to destinations. In light of the comparative RDI results it was decided to use a 140% RDI as the base line figure in calculating the excess variance of travel to destinations. This means that the actual straight-line distance was multiplied by 140% to produce a modified deviation distance. This modified deviation distance gives us a distance, that can be considered a normal traveling distance in relation to the straight-line distance. Anything above this distance can reasonably said to be excess travel distance. The modified figure was then used to calculate aggregated excess travel distance to the destination from the selected residences of the case study area. This excess travel distance figure could then be used to calculate an estimate for excess travel costs in running a car to a minimum number of weekly destinations.

The following Table 5.7 shows aggregated distance calculations from all 10 residences to each of the selected destinations. It has been used to indicate how much excess travel may be involved for the residents of the selected residences to the destinations.

Table 5.7: Excess travel estimates per single journey

Destination	Aggregate straight line distance m	Modified deviation distance m	Actual road route distance m	Excess travel distance m
A	14032	19645	33480	13835
B	8660	12124	17700	5576
C	5520	7728	9530	1802
D	6985	9779	10630	851
E	10610	14854	13550	-1304
F	12980	18172	16770	-1402
G	7665	10731	11020	289
H	13995	19593	30890	11297
J	16660	23324	29790	6466
K	15950	22330	22090	-240

It is reasonable to believe that residents would not travel to each destination equally. To be able to calculate an estimated journey week for an individual resident and to calculate an indicative extra travel cost to the resident, the proposal is that, in the course of a week, they are likely to make:

- 5 round trips to destination A, Robina Town Centre making 10 journeys
- 1 round trip to destination B, Parkway medical centre making 2 journeys
- 5 round trips to destination C, Robina State School making 10 Journeys
- 1 round trip to either destination D or G making 2 journeys
- 7 round trips to either destination E or F making 14 journeys
- 5 round trips to either destination H or J making 10 journeys
- 1 round trip to destination K making 2 journeys

This then has to be divided by 10 to average out the results from 10 residences. Using this method the excess travel distance per resident was calculated as 23.8 km per week. It is accepted that for some people it would be more or less depending on their travel needs. This extra 23.8 km per week results in the following costs per resident per week if the RACQ costs in table 5.6 figures are applied:

- In a Hyundai i30 SX T \$12.95
- In a Honda Civic Hybrid \$15.62
- In a Ford FG Falcon XT \$20.13

They will also consume extra fuel resulting in the release of increased carbon emissions based on 2.3 kg CO₂ emissions per litre of petrol (timeforchange.org, 2008).

- In a Hyundai i30 SX T 1.09 litres and 2.52 kgs of CO₂ emissions
- In a Honda Civic Hybrid 1.42 litres and 3.28 kgs of CO₂ emissions
- In a Ford FG Falcon XT 2.5 litres and 5.75 kgs of CO₂ emissions

If only half the estimated 3200 residents of the suburb drive this much excess distance, the significance of these calculations becomes apparent. In this conservative scenario the residents of the suburb of Robina Woods will use an extra 2672 litres of fuel and produce an extra 6146 kgs of CO₂ emissions per week in comparison to similar residents who live in a suburb with a grid structure road system.

N.B.

The ped shed and RDI maps are presented in the following section in landscape format. Whilst it is recognised that this is not an ideal format, difficulties with the software precluded the images with text being placed in a portrait format and the enhanced ability to read through the set of maps when presented in a landscape format was thought to be the best compromise.

6.0 The ped shed Maps

The research maps are presented together in this section.

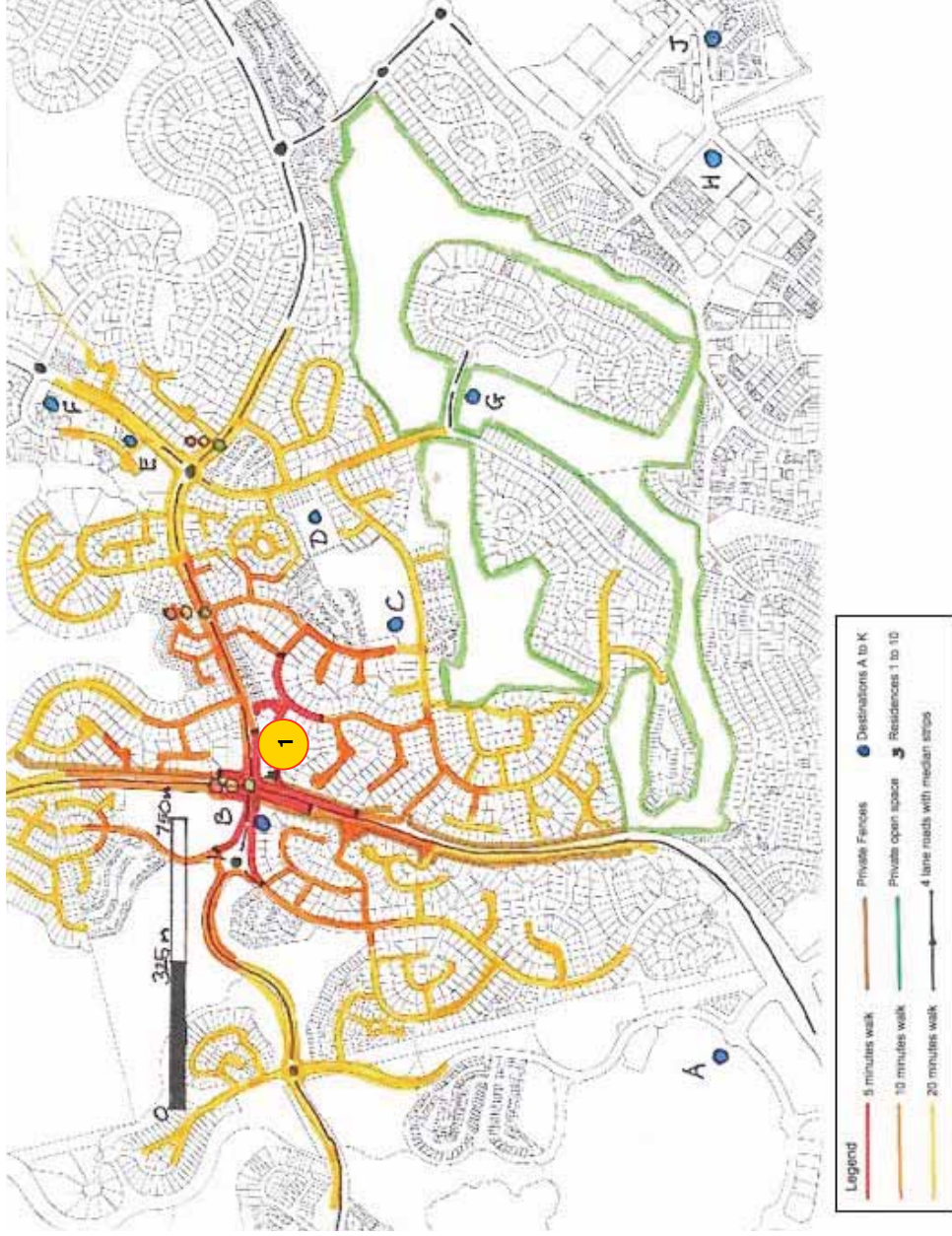
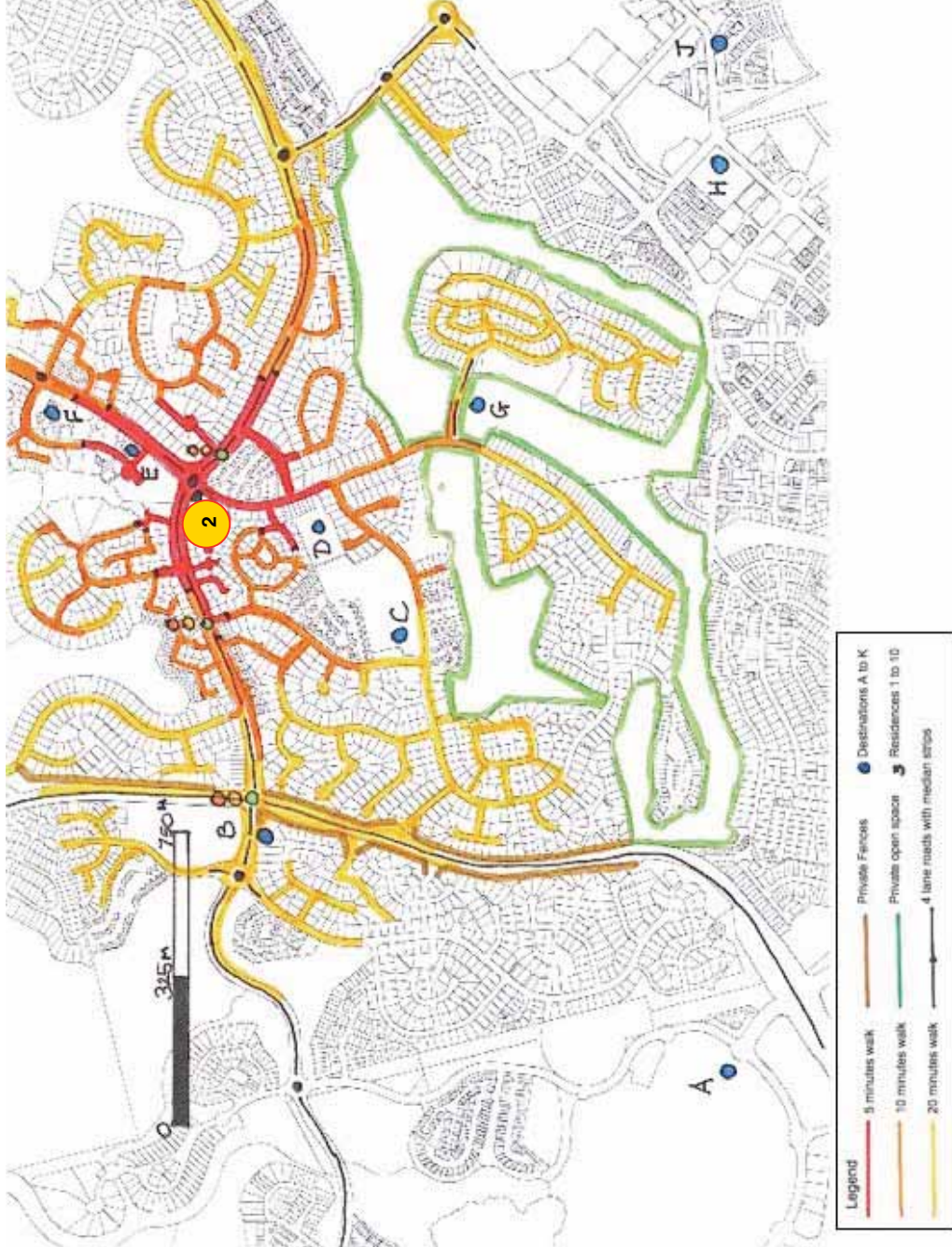


Figure 6.1: The ped shed pattern from residence 1

Residence 1 was selected, as it is closest to the Parkway Medical Centre. It is also in the extreme northwest of the study area and adjacent to a major road intersection. Residence 1 benefits from its position close to the intersection to reach a good penetration of the local urban street structure.

The residence does not front onto either road and is separated from the roads by high fences. The immediate terrain around residence 1 has steep slopes; permeability beyond the Robina Parkway/Cheltenham Drive intersection is subject to traffic conditions and the timing of the traffic lights. The mapping analysis indicates:

A pedestrian can reach one destination within 5 minutes. They do not reach any further destinations within 10 minutes. They can reach a further four destinations within 20 minutes. A pedestrian cannot reach the five remaining destinations within 20 minutes.



Residence 2 was selected, as it is closest to the Quays shopping centre. It is also on the northern edge of the study area and adjacent to a major road intersection. Residence 2 appears to benefit from its position adjacent to the intersection to achieve the best penetration of the local urban street structure of any of the residences chosen.

Residence 2 has a street frontage onto Ron Penhaligon Way. The mapping analysis indicates:

A pedestrian can reach two destinations within 5 minutes. They can reach a further two destinations within 10 minutes. They can reach a further three destinations within 20 minutes. A pedestrian cannot reach the three remaining destinations within 20 minutes.

Figure 6.2: The ped shed pattern from residence 2

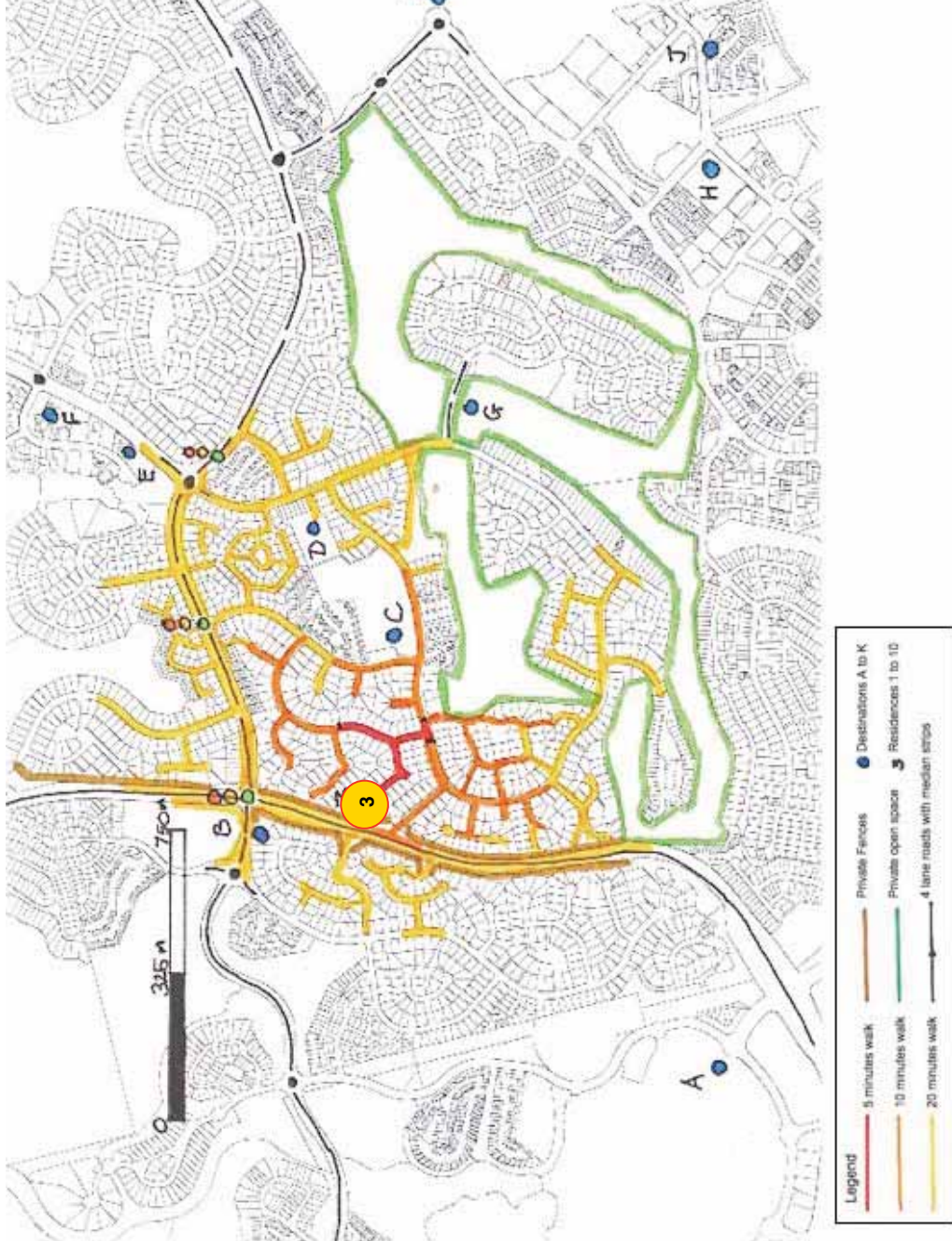
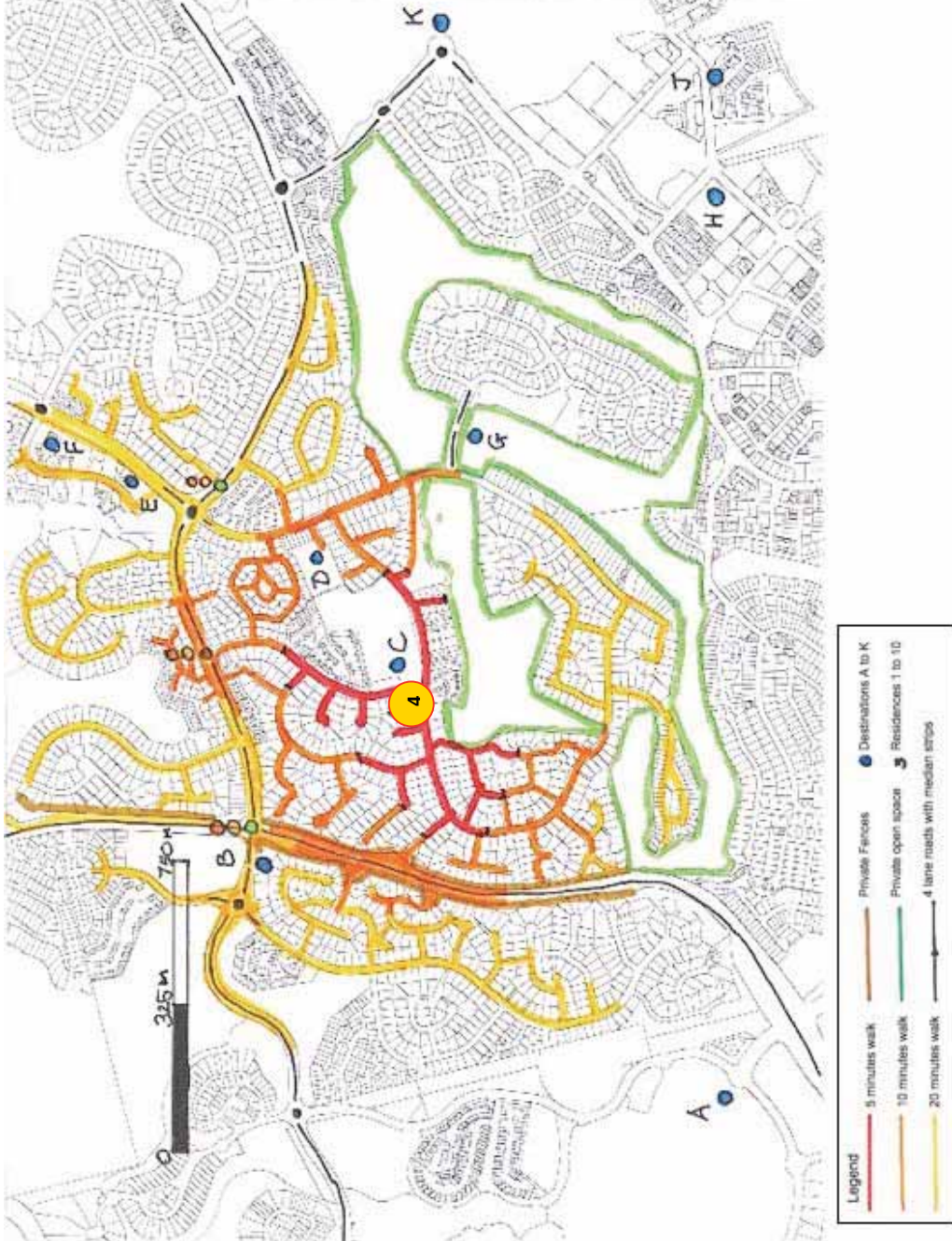


Figure 6.3: The ped shed pattern from residence 3

Residence 3 was selected as one of the residences adjacent but without direct access to Robina Parkway. The streets around the residence have steep slopes. The penetration of the local urban street structure appears to be limited by Robina Parkway, the layout of the cul de sacs and the golf course. The mapping analysis indicates:

A pedestrian cannot reach any destinations within 5 minutes. They can reach one destination within 10 minutes. They can reach a further two destinations within 20 minutes. A pedestrian cannot reach the seven remaining destinations within 20 minutes.



Residence 4 was selected as closest to Robina State School it is also close to the centre of the suburb. It appears to have a good penetration of the local urban street structure to the north and west. The golf course restricts this to the south and east.

A pedestrian can reach one destination within 5 minutes. They can reach a further destination within 10 minutes. They can reach a further four destinations within 20 minutes. They cannot reach the four remaining destinations within 20 minutes.

Figure 6.4: The ped shed pattern from residence 4

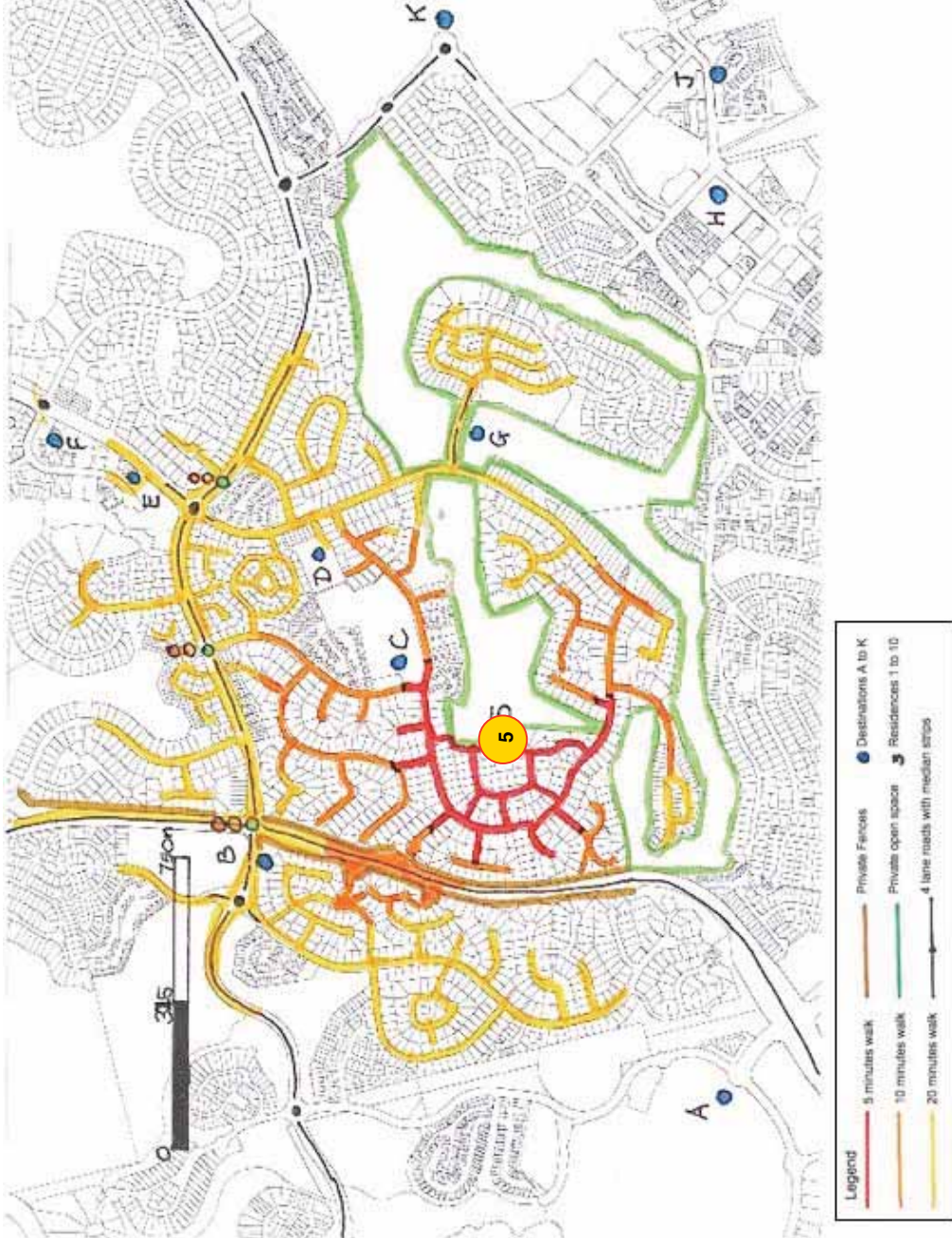
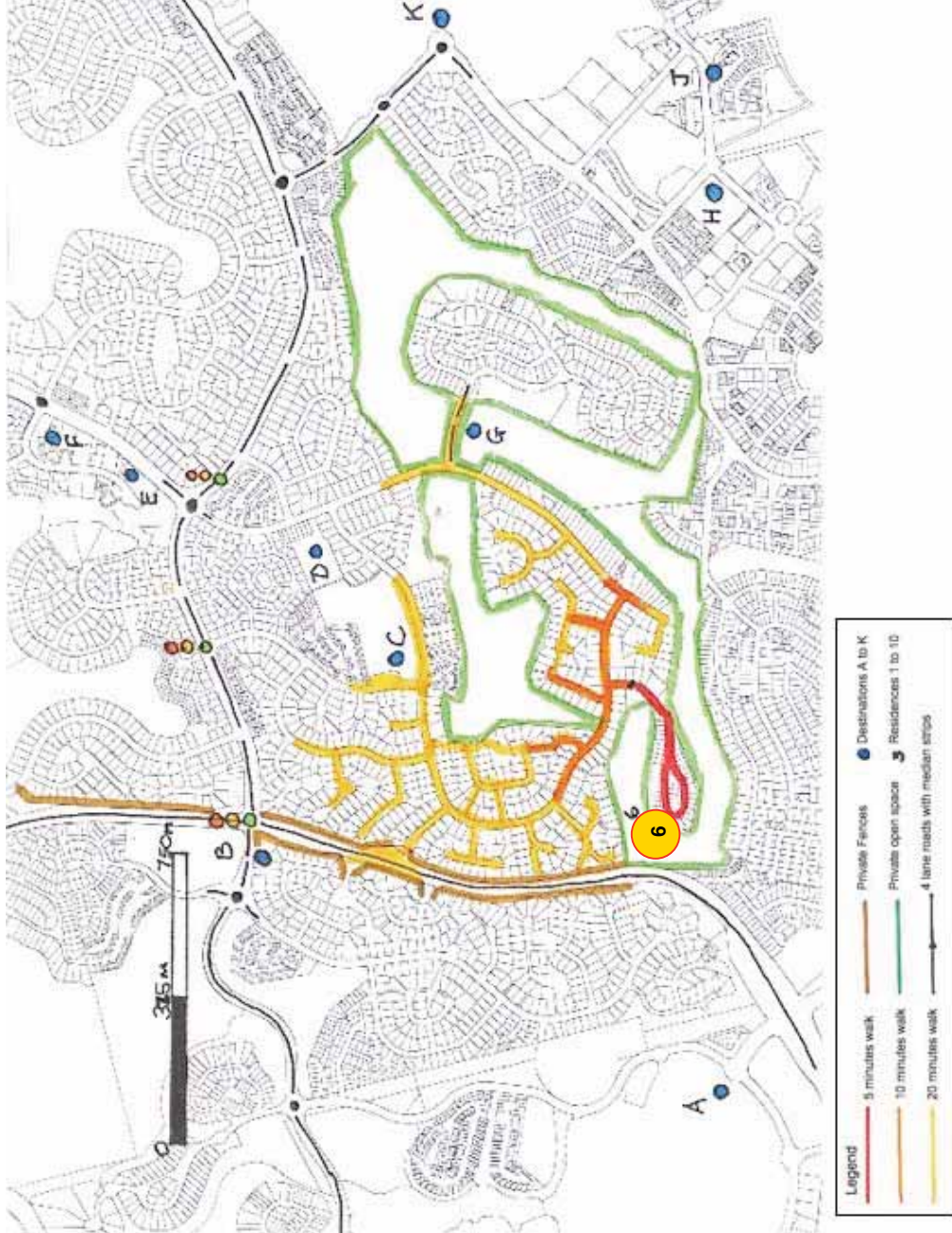


Figure 6.5: The ped shed pattern from residence 5

Residence 5 was selected as one of the residences closest to the geographical centre of Robina Woods. It is also located on a small local pedestrian park pathway and adjacent to the golf course fence. The mapping analysis indicates:

Pedestrian penetration of the local urban street structure is restricted to the south and east by the golf course and to the west by Robina Parkway and the adjacent cul-de-sacs. It has some advantage in its position on a pedestrian pathway that allows access to more exit options than residence 7.

A pedestrian can reach one destination within 5 minutes. They cannot reach any other destinations within 10 minutes. They can reach four more destinations within 20 minutes. They cannot reach the five remaining destinations within 20 minutes.



Residence 6 was selected as the residence physically closest to Robina Town Centre. The residence is located in a gated community and adjacent to the Golf course fence.

Pedestrian travel from the residence is very restricted by the Golf Course, Robina Parkway and the adjacent cul-de-sacs. Permeability and pedestrian options from this residence is probably the worst in the Robina Woods.

Results for the analysis indicate: A pedestrian can reach two destinations within 20 minutes. They cannot reach the eight remaining destinations within 20 minutes.

Figure 6.6: The ped shed pattern from residence 6

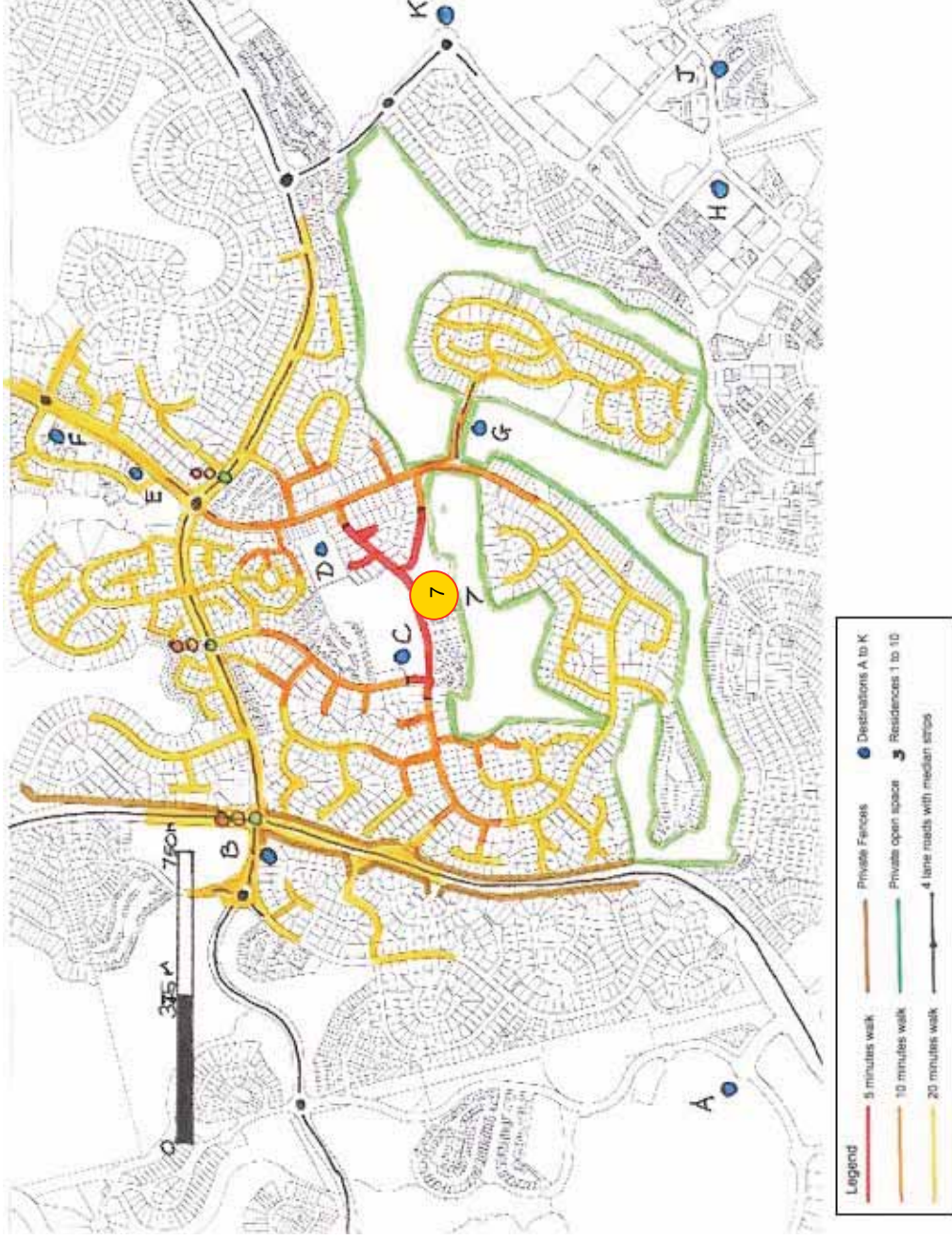


Figure 6.7: The ped shed pattern from residence 7

Residence 7 was selected as close to the geographical centre of the suburb, adjacent to the golf course and between the three destinations within Robina woods. Despite its centrality the limited exit choices from the street restrict the penetration of the local urban street structure within ten minutes. The mapping analysis indicates:

A pedestrian can reach one destination within 5 minutes. They can reach a further two destinations within 10 minutes. They can reach a further three destinations within 20 minutes. A pedestrian cannot reach the four remaining destinations within 20 minutes.



Figure 6.8: The ped shed pattern from residence 8

The Robina Residential Archipelago

Residence 2 was selected as one of the closest to the neighbouring suburb of Varsity Lakes. It is in the south of the study area and adjacent to the golf course. The penetration of the local urban street structure is restricted by the golf course, Robina Parkway and the cul de sac layout. The mapping analysis indicates:

A pedestrian cannot reach any destination within 5 minutes. They can reach one destination within 10 minutes. They can reach a further two destinations within 20 minutes. They cannot reach the seven remaining destinations within 20 minutes.



Figure 6.9: The ped shed pattern from residence 9

Residence 9 was selected as closest to Bond University. It is also on the eastern edge of the study area and adjacent to the golf course.

The penetration of the local urban street structure is restricted by the causeway connection to the rest of the suburb and the barrier of the golf course. The mapping analysis indicates:

A pedestrian can reach a destination within 5 minutes. They cannot reach a further destination within 10 minutes. They can reach a further three destinations within 20 minutes. A pedestrian cannot reach the six remaining destinations within 20 minutes.



Figure 6.10: The ped shed pattern from residence 10

Residence 10 was selected as closest to Varsity College it is also adjacent to the golf course and in the south of the study area. The penetration of the local urban street structure is very poor. With a conventionally drawn shed it should be able to access six destinations in ten minutes. The mapping analysis indicates:

A pedestrian cannot reach any destination within 5 minutes. They can reach one destination within 10 minutes. They can reach a further two destinations within 20 minutes. They cannot reach the seven remaining destinations within 20 minutes.

6.1 The road deviation index (RDI) maps



Table 6.1: Vehicle journey distances originating from destination A

Residence	Straight line distance m	Road route distance m	Variation m
1	1361	2710	1349
2	1966	2620	654
3	1110	3090	1980
4	1295	2640	1345
5	1060	3550	2490
6	660	4080	3420
7	1460	3160	1700
8	1180	3790	2610
9	2150	3940	1790
10	1790	3900	2110
Aggregates	14032	33480	19448

For travel from destination A the road deviation index (RDI) is 238.6

This is an extremely poor result for the most significant local destination for residents of Robina Woods and indicates an urgent need for assessment of the current road structure.

Figure 6.11: The RDI map from Robina Town Centre to the selected residences

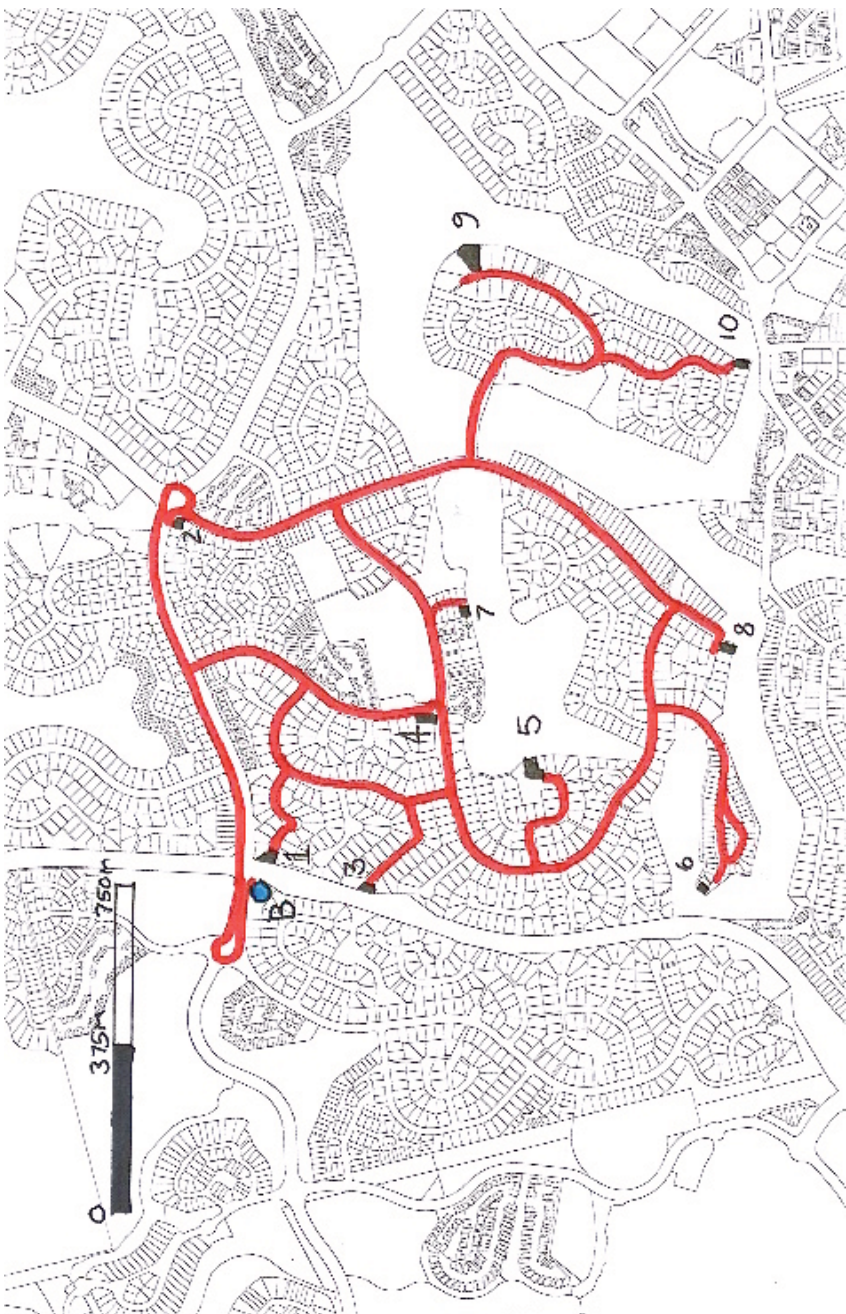


Figure 6.12: The RDI map from Parkway Medical Centre to the selected residences

Table 6.2: Vehicle journey distances originating from destination B

Residence	Straight line distance m	Road route distance m	Variation m
1	110	1150	1050
2	870	1020	150
3	290	1320	1030
4	570	1070	500
5	685	2120	1435
6	1005	2740	1735
7	810	1420	610
8	1200	2180	980
9	1520	2360	840
10	1600	2320	720
Aggregates	8660	17700	9050

For travel from destination B the RDI is 204.5

This result indicates a very poor level of connectivity to an important facility for Robina Woods residents that would appear to require urgent attention.

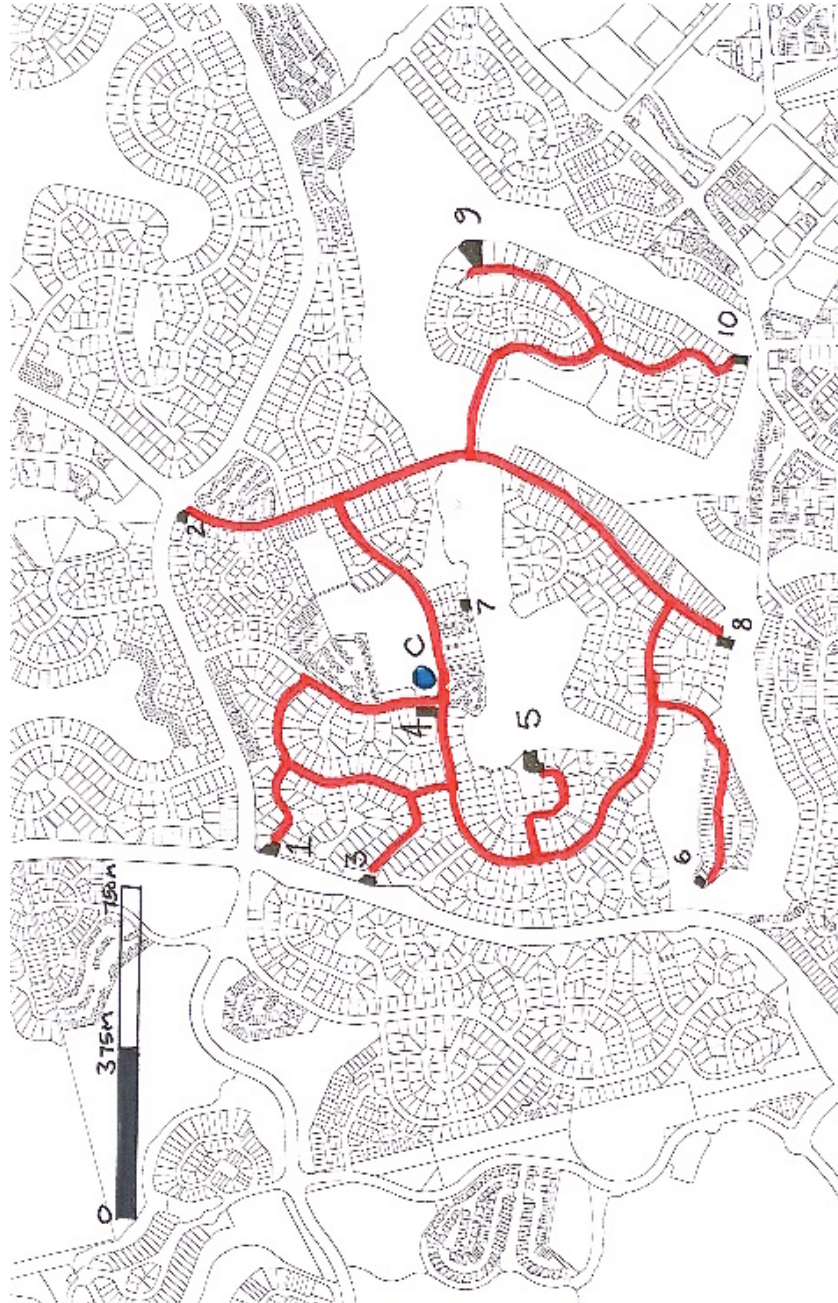


Figure 6.13: The RDI map from Robina State School to the selected residences

Table 6.3: Vehicle journey distances originating from destination C

Residence	Straight line distance m	Road route distance m	Variation m
1	490	730	240
2	620	850	230
3	470	580	110
4	90	No journey	0
5	310	910	600
6	770	1400	630
7	210	300	90
8	700	1600	900
9	950	1600	650
10	1000	1560	560
Aggregates	5520	9530	4010

Residence 4 would take longer to drive past a school crossing turn into parking bay and park the car than cross the road on foot.

For travel from destination C the RDI is 172.64

This is a good result that could be better considering its central position in the suburb.

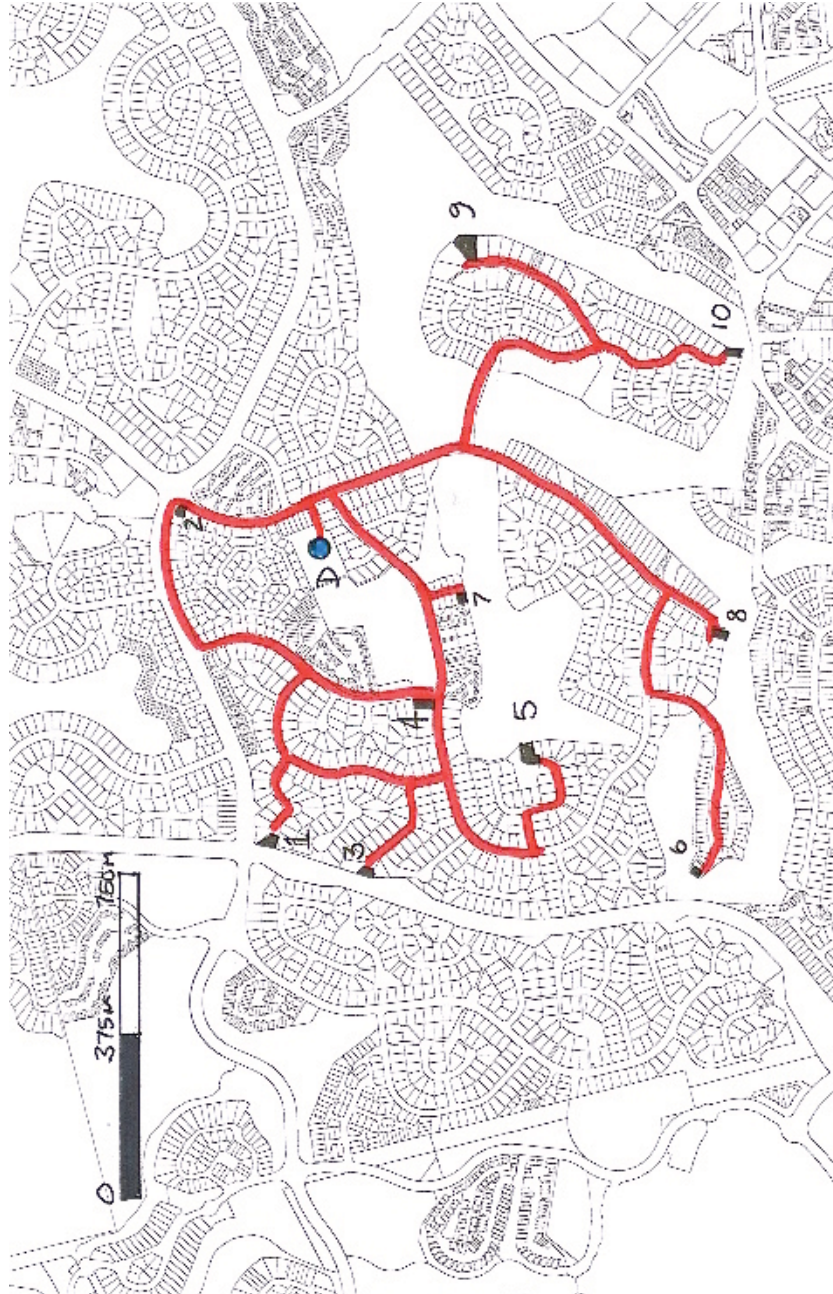


Table 6.4: Vehicle journey distances originating from destination D

Residence	Straight line distance m	Road route distance m	Variation m
1	700	1370	670
2	315	330	15
3	780	990	210
4	440	700	260
5	680	1530	850
6	1130	1650	520
7	340	420	80
8	910	1160	250
9	710	1260	550
10	980	1220	240
Aggregates	6985	10630	3645

For travel from destination D the RDI is 152.2

This is a good result for the urban connectivity of the Bowls Club

Figure 6.14: The RDI map from Robina Bowls Club to the selected residences

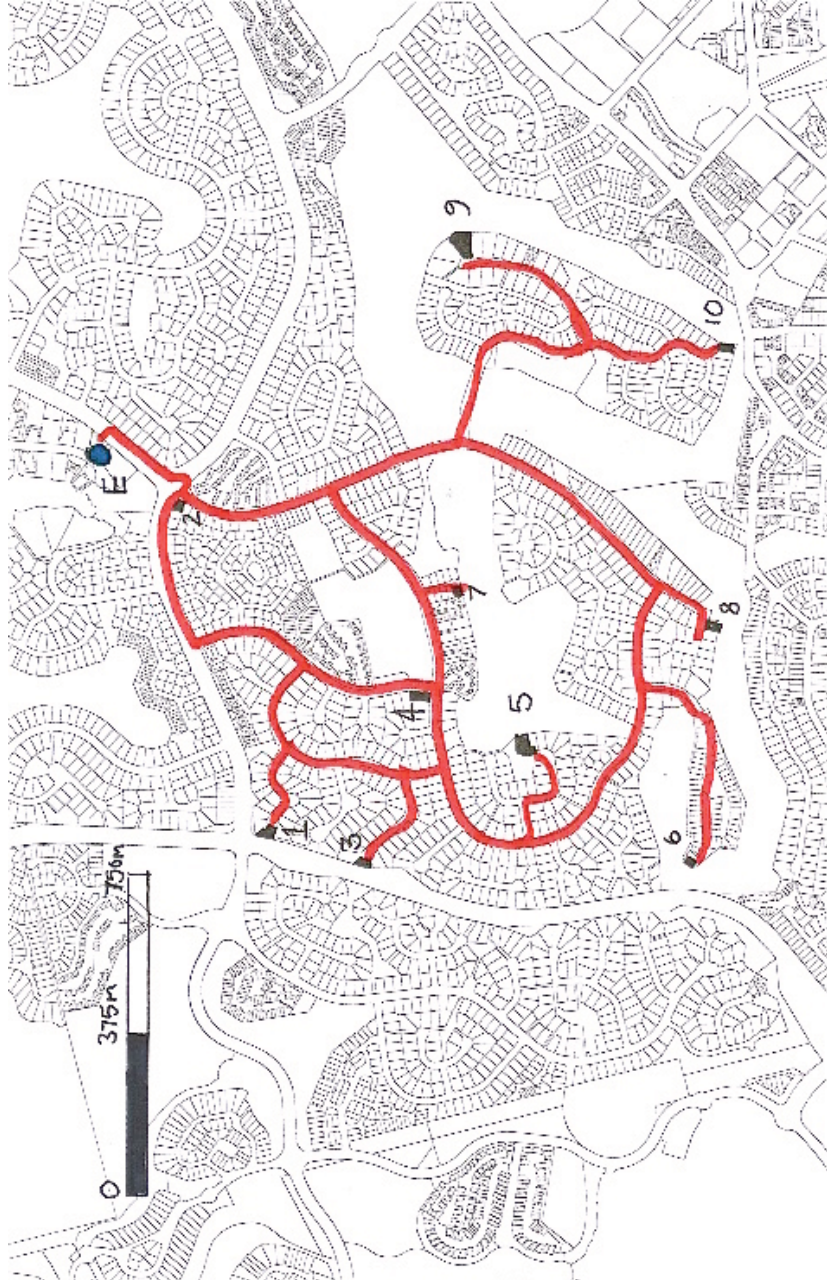


Figure 6.15: The RDI map from Robina Quays Centre to the selected residences

Table 6.1: Vehicle journey distances originating from destination E

Residence	Straight line distance m	Road route distance m	Variation m
1	940	1250	310
2	220	260	40
3	1130	1410	280
4	920	1100	180
5	1170	1880	710
6	1625	2030	405
7	865	910	45
8	1430	1510	80
9	910	1620	710
10	1400	1580	180
Aggregates	10610	13550	2940

For travel from destination E the RDI is 127.7

This is a very good result for the urban connectivity of the Robina Quays centre. It is a better connectivity than could be expected from a grid structure.



Figure 6.16: The RDI map from Robina Village to the selected residences

Table 6.6: Vehicle journey distances originating from destination F

Residence	Straight line distance m	Road route distance m	Variation m
1	1220	1560	340
2	450	680	230
3	1320	1800	480
4	1340	1480	140
5	1380	2160	780
6	1840	2390	550
7	1090	1180	90
8	1665	1760	95
9	1070	1900	830
10	1605	1860	255
Aggregates	12980	16770	3790

For travel from destination F the RDI is 129.2

This is a very good result for the urban connectivity of the Robina Village. It is a better connectivity than could be expected from a grid structure.



Figure 6.17: The RDI map from Robina Golf Course to the selected residences

Table 6.7: Vehicle journey distances originating from destination G

Residence	Straight line distance m	Road route distance m	Variation m
1	1110	1730	620
2	715	730	15
3	1095	1400	305
4	710	870	160
5	825	1770	945
6	1160	1500	340
7	405	800	395
8	750	860	110
9	335	700	365
10	560	660	100
Aggregates	7665	11020	3355

For travel from destination G the RDI is 143.7

This is a good result for the urban connectivity of the golf club.

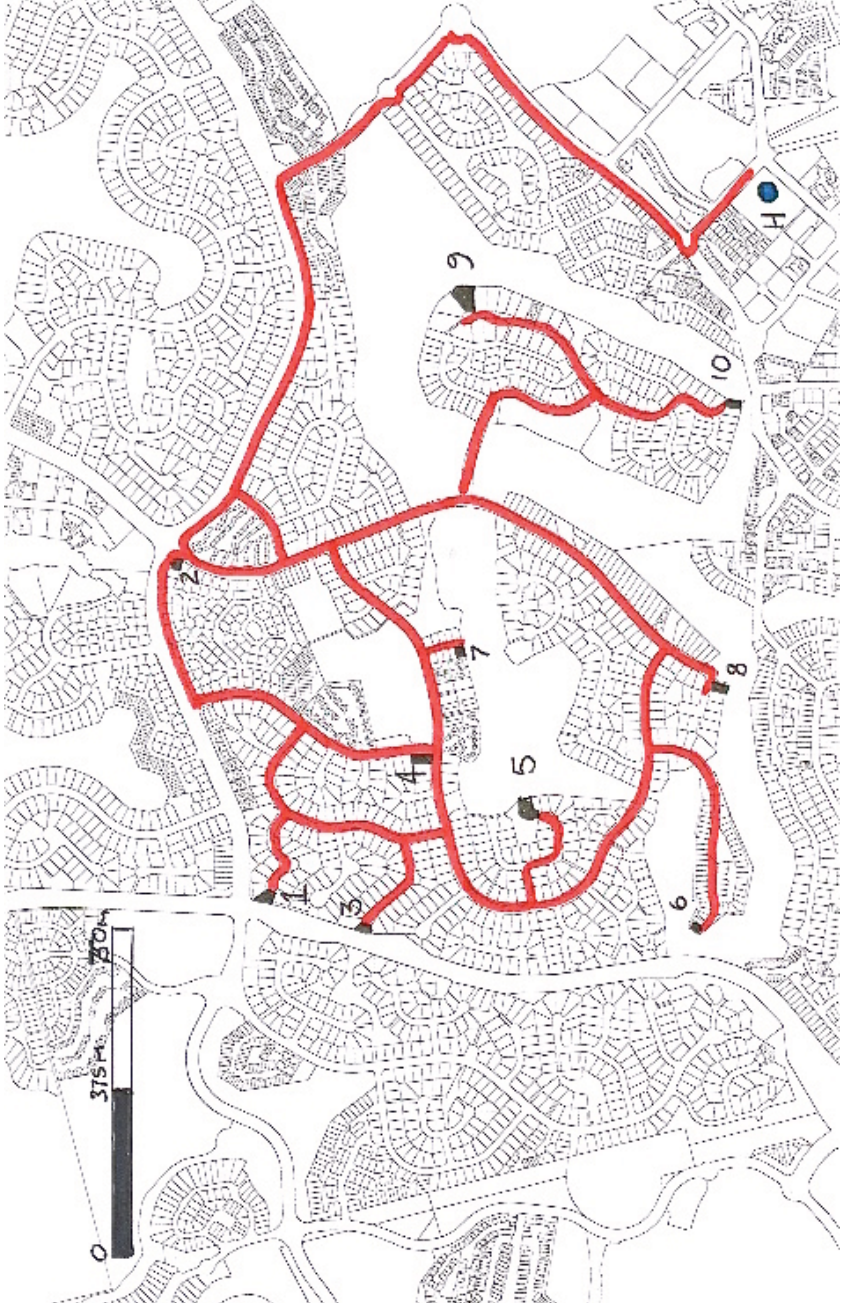


Table 6.8: Vehicle journey distances originating from destination H

Residence	Straight line distance m	Road route distance m	Variation m
1	1980	3280	1300
2	1575	2320	745
3	1920	3440	1520
4	1525	3250	1995
5	1540	3730	2190
6	1705	3920	2215
7	1275	2770	1495
8	1180	3320	2140
9	745	2450	1705
10	550	2410	1860
Aggregates	13995	30890	17165

For travel from destination H the RDI is 222.6

This is an extremely poor result for the urban connectivity of Varsity College to Robina Woods. Considering its importance to the Robina Woods community it would appear that this situation requires urgent attention.

Figure 6.18: The RDI map from Varsity College to the selected residences



Figure 6.19: The RDI map from Market Square Varsity Lakes to the selected residences

Table 6.9: Vehicle journey distances originating from destination

Residence	Straight line distance m	Road route distance m	Variation m
1	2245	3170	925
2	1760	2210	450
3	2200	3330	1130
4	1795	3140	1345
5	1835	3620	1785
6	2020	3810	1790
7	1550	2660	1110
8	1480	3210	1730
9	900	2340	1440
10	875	2300	1425
Aggregates	16660	29790	13130

For travel from destination J the road deviation index is 178.8

This is a very poor result for the urban connectivity of the Market Square centre. This result probably affects the commercial viability and vitality of the centre and Robina Woods.

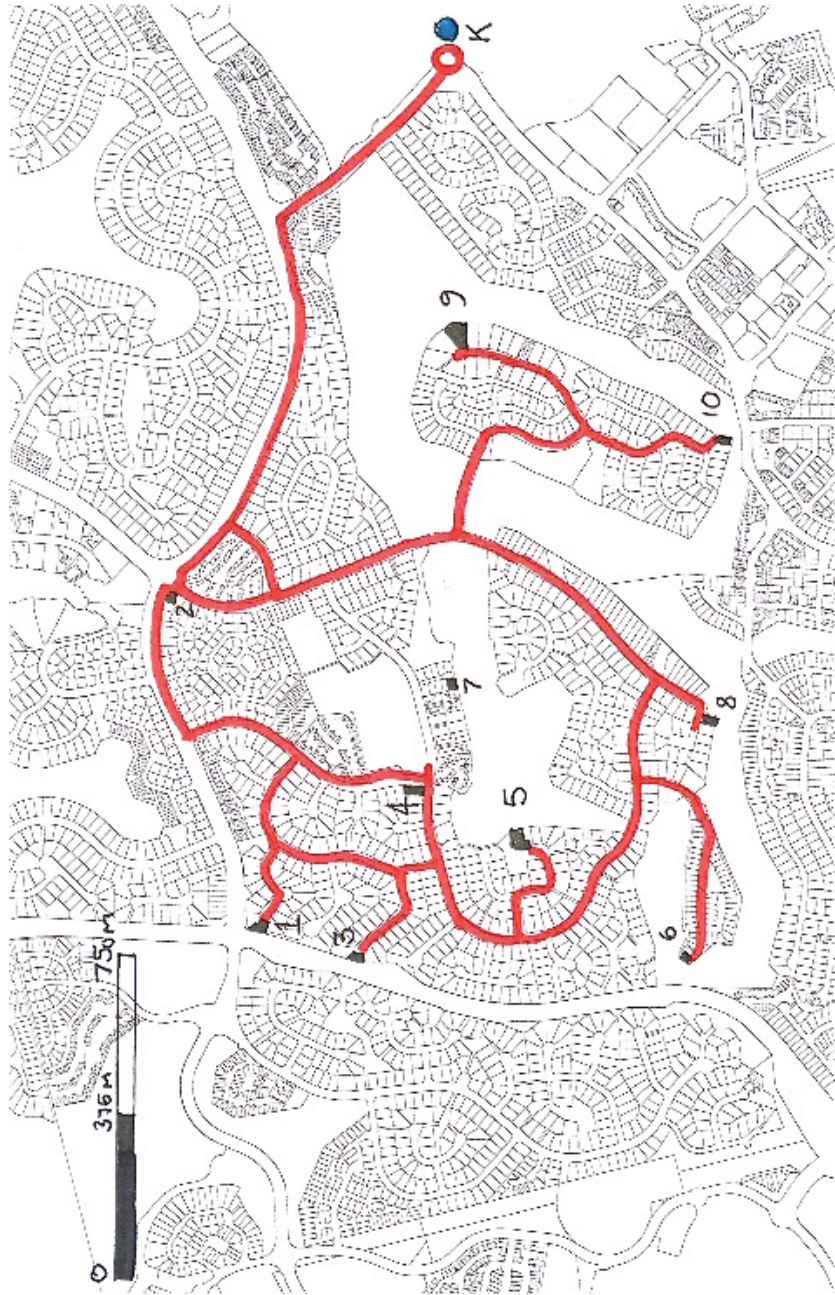


Figure 6.20: The RDI map from Bond University to the selected residences

Table 6.10: Vehicle journey distances originating from destination

Residence	Straight line distance m	Road route distance m	Variation m
1	2045	2380	335
2	1395	1420	25
3	2075	2540	465
4	1680	2350	670
5	1810	2830	1020
6	2130	3020	1585
7	1435	1870	435
8	1630	2620	990
9	665	1550	885
10	1085	1510	425
Aggregates	15950	22090	6835

For travel from destination K the RDI is 138.5

This is a reasonable result for the urban connectivity of the Robina Quays centre. It could be expected to be better if the southern residences of Robina Woods could exit through the southern boundary of the suburb.

7.0 Conclusions

The original research questions chosen to guide this research project were:

1. What is the current nature of the urban connectivity of Robina?
2. How does the current urban design and connectivity impact on the residents of the suburbs?
3. What measures could be taken to improve the urban design and connectivity?

This research paper has set out, within the limits of its research, to describe the nature of urban connectivity in Robina and in the case study area of Robina Woods. This was primarily done utilising an analysis of the barriers to connectivity and mapping the ped sheds and road deviation index with the maps in Section Six. The analysis of those maps in Section Five presents a picture of the current urban connectivity through these maps. Urban connectivity in the context of this research project has been defined as *The degree to which the urban form allows people to travel to retail, education, health, employment, professional, social and recreational facilities from their homes on foot, by bicycle, public transport or private vehicle.*

The evidence gathered in this research project suggests that there is significant disruption to the urban connectivity of Robina Woods to its southern and western boundaries. There is also cause for concern for the quality of the pedestrian environment. For such a large and central suburb the provision of destinations, landmarks, public facilities and streetscapes can be seen to be below what could be expected in a small rural Queensland town with a similar population. The nature of this urban form has been caused by its car dependent design that appears to have been driven more by marketing principles and 20th Century planning conventions than sound new town planning.

The long-term sustainability of such an urban form, dependent as it is on the private vehicle is questionable. The concentration of goods, services and employment in centres such as Robina Town Centre makes the poor provision of these essentials within Robina Woods a problem that will be difficult to address. Should society change significantly a suburb without the goods services and employment necessary for a reasonably urbane

society within its boundaries may become much less desirable. One scenario of this would be if the working patterns moved more to part time and working from home, people would find there is no where to go within the suburb.

7.1 The nature of the urban connectivity for the residents of Robina

The conclusion of this paper is that, in comparison to known best practice and examples drawn from other residential examples, many residents of Robina have a low degree of ability to travel by anything other than private vehicle to the amenities, facilities and employment they need outside of their residential archipelagos. The ability to meet these needs is also restricted by the variety, number and choice of destinations within their suburbs. Walkability is severely restricted by the design and spatial layout of the street patterns and the actual distances involved.

The efficiency of the road network is very poor, surprisingly so for Robina Town Centre, considering the intent expressed by the developer in the Robina Profile 1999 (Robina Land Corporation, 1999) to make it the premier shopping and commercial centre of the Gold Coast. This has not yet been achieved. The adjacent suburb of Robina Woods has an inefficient and problematic hierarchical road structure. A simple analysis of this structure indicates that a blockage along many points on Robina Parkway and Cheltenham Drive would cause long diversions and delays for travellers due to a lack of permeability and optional routes.

The urban connection to the neighbouring suburb of Varsity Lakes is extremely poor. The barrier to urban connectivity that the Robina Woods Golf Course produces requires immediate attention. It is not acceptable, in the view of the author, that private ownership and limited special interests over such spatially strategic land should prevent suitable outcomes for the many residents adjoining this key private open space. Originally it was a useful marketing tool to draw residents to a green and leafy suburb. However, times change and so do the obligations of developers and land owners. It would be hoped that key routes could be opened especially to Varsity College and Market Square. The redevelopment of the golf course could be beneficial to all either in a modified form or as a connecting urban environment that has learnt lessons from the past.

There is an obvious need to improve the number of destinations within the suburbs, the quality of streets and the sense of place in order to foster social capital in engaged neighbourhoods and to engage, inform and involve the local community in setting goals and finding solutions to the current and future sustainability of their suburbs.

7.2 The reasons for change to the urban connectivity of Robina

There are many reasons why changing the urban form and its attendant low levels of connectivity will be difficult, expensive, socially and politically divisive. However there are significant and enduring reasons for addressing the issues that have arisen from oversight, poor planning and the marketing based urban design policies and practices of the past.

These reasons for change are current and impending. They include:

- The current physical and mental health costs (Australian Local Government Association et al., 2008)
- The loss of social capital (Australian Local Government Association et al., 2008).
- The lack of mobility choices for people without cars, especially the disadvantaged, younger, and older residents.
- The impending increase in the size and proportion of the older demographic of the population with attendant demands on social and physical infrastructure.
- The changing demographic profile of the community that will see a need for a wider range of housing choices than currently exists in suburbs like Robina Woods.
- The inevitability of change in economic, social and environmental conditions best met by a resilient urban form that can adapt to those changes
- The ageing populations forecast increased need for more support to enable it to remain mobile and engaged in the community
- The lack of adaptability to change of an urban form dependent on the car for its mobility

7.3 The challenges for the future sustainability of Robina

There are high financial costs to be borne if no action is taken. Residential suburbs that do not adapt may find themselves falling in desirability and value if they ignore the current levels of urban connectivity. Financial costs of higher vehicle kilometres travelled for residents and services could become critical as fuel prices rise. The externalised costs of underdeveloped suburbs will fall on future ratepayers who will be called on to repair and maintain the physically extensive infrastructure network.

There are also the external forces of a restructuring economy currently facing a crisis of confidence. The likely and possible effects of peak oil and climate change are still being decided, but they are unlikely to support an inefficient and carbon fuel intensive urban form dependent on the automobile for its existence. Even if the worst predictions of the future costs of private transport and economic crisis do not eventuate, there is going to be a level of stress on residents who live in suburbs like Robina. The long-term benefits of improving urban connectivity are too high to be ignored by the public, politicians and public servants forever.

There is, however, a need to raise awareness of the problem and the quality and visibility of political debate. Engineers, architects, urban designers, planners, developers, financiers, and politicians will need to engage in finding solutions rather than reacting to problems after they have occurred. In and of themselves no one profession or group is seen as having the resources or abilities to solve the difficult problems that the current urban form presents.

The author recognises that the designers and builders of Robina and Robina Woods had different motivation to current writers in urban design, such as Llewellyn Davies. Although it is surprising that the car dependent option was pursued considering that the evidence was there in the 1980s that this may have been an unwise option. There is also troubling evidence that nothing has been learnt from suburbs like Robina and car dependent design continues to dominate development in the Gold Coast and can be seen to be still occurring in recent developments. The author believes it is not responsible to accept that,

as events have already occurred, we are trapped and unable to do anything about the urban form. The findings of the lack of walkability and road connectivity in Robina Woods should not be seen as an inescapable reality but an opportunity to improve and modify the existing environment for the benefit of current and future generations.

7.4 The possible solutions for Robina residents

The evidence in this research paper is that there is now and will continue to be a need to propose, examine and implement changes which can deliver better social, economic, environmental and health outcomes for the current and future residents of Robina and residential suburbs like it within the Gold Coast and Australia. The following suggestions are by no means comprehensive or definitive answers to the problems of poor urban connectivity. It is thought that the answer will lie in a cooperative and coordinated program of action and policy from all stakeholders in the built environment including, the public and politicians, planners, urban designers, architects, engineers, developers, educators and financiers. The following suggestions are put forward as adaptations of the suggestions of others and from the author's own local observations of opportunities.

- I. Redesign the method of calculating rates to reflect the extra costs of collecting wastes and delivering infrastructure to low density areas with inefficient road systems that pass those costs on to ratepayers who live in better urban forms.
- II. Levy a carbon charge in the rates to help pay for retrofitting of suburbs based on the carbon footprint of households
- III. Provide an advisory service and subsidies to residents who reduce their carbon footprint or enter into on site water collection and waste processing
- IV. Revitalisation of the residential suburbs to provide for a greater range of housing, employment and social activities to help create sustainable neighbourhoods
- V. Increasing population densities by utilising mixed-use redevelopment of low density development in new centres along transit corridors or at crossroads
- VI. Setting finite limits on the urban footprint of the Gold Coast which will force a change in development strategies by construction companies, rather than allowing

them to demand continual expansion of that urban footprint as their preferred soft option.

- VII. Redevelopment of existing buildings, structures, infill, and conversion. (Williams et al 1999 and 2000)
- VIII. Reconfiguration of lots to provide larger development blocks at designated “village” centres such as the Ron Penhaligon, Cheltenham and Cottesloe roundabout and along transit corridors such as Robina Parkway
- IX. Public funding of affordable housing redevelopment from low to higher density in those village centres and along transit routes.
- X. Utilising New Urbanist and Smart growth strategies to guide development
- XI. Development of alternate road routes that open the western and southern boundaries
- XII. Redevelopment or redesign of Robina Woods Golf Course to allow road and or pedestrian routes to Varsity Lakes
- XIII. The design of a master plan for the renewal of the suburb in partnership with developers to replace the current planning provisions and repeal of the act of parliament which authorises this development.
- XIV. The provision of public amenities and destinations in that masterplan to make the suburb a more resilient and adaptable community

7.5 The benefits for Robina residents and the wider community

The urban development pattern for Robina is by no means unique. Examples of similar or worse urban connectivity can be seen throughout the Gold Coast and beyond. It is reasonable to expect that similar barriers exist in other communities throughout Australia especially those new town developments and expansions of existing urban form built from the 1960s onward.

The solutions to those problems need to be found by consensus and the involvement of the community. This will help to raise awareness of urban design issues in the general population much as was done during the recent water crises in South East Queensland. The benefits of change need to be communicated to the wider population, some of those benefits are seen as:

- The improved physical and mental health of the residents
- Increased neighbourhood social capital and social activity
- Economic benefits from a more efficient public infrastructure and transport system
- Improved choices for use of time with reduced commuting times
- The compact city is the most favourable sustainable urban form (Elkin et al 1991, Nolan and Stewart 1991)
- A more resilient and sustainable urban form will cope better with peak oil and climate change
- By developing polycentric suburbs in the Gold Coast, Robina will contribute to the development of a less linear Gold Coast City
- Reduction of the need for multiple private vehicles for households in Robina with the concurrent costs of vehicle ownership
- Reducing travel times within the suburb and to its neighbouring suburbs
- Reduction of Vehicle Kilometres Travelled (VKT) and a reduction in Greenhouse Gas Emissions (GHG) by the suburbs

7.6 Designing a solution to car dependent suburb

Only representative partnerships of stakeholders can reach successful solutions to our current problems. It is not realistic to expect the self interest of private firms to produce optimal results for the wider community, as explained by Alan Greenspan (Nason, 2008) in recent statements on the current banking failures in the US. There will be a need for private and public capital to solve current problems, but the regulation of a robust design process is needed to ensure the best results for the community as a whole.

The difficulties that present in re engineering the residential archipelago are substantial and make the need for a sustained and coordinated, political and economic solution a prerequisite in the design of any solutions. The above diagram in Figure 7.1 is a simplified design cycle that shows the relationship between the components for a successful design solution. Like any design cycle it is acknowledged that there is no specific start or finish point and that the cycle may be initiated at any point in its revolution.

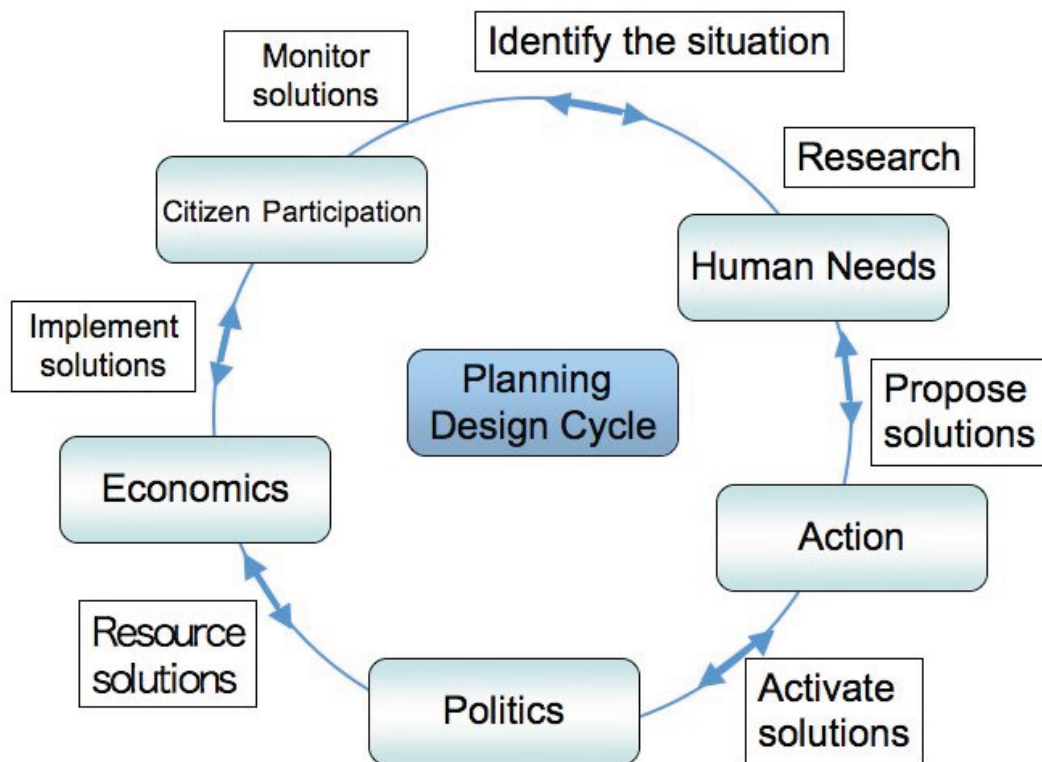


Figure 7.1: The Proposed Planning Design Cycle

During the course of the research project, the number of people and professions involved, the number of factors and the complexity of the urban design process in the development of new towns was observed. This motivates the author to propose that there should be some mechanism to include a design cycle analysis into the planning and development of both new and existing urban form. The existence of the consortium of The Australian Local Government Association, National Heart Foundation and the Planning Institute of Australia which produced the draft discussion paper “Healthy Spaces and Places: Towards and National Planning Guide” gives some hope that a coordinated response may be on its way.

There are many other hopeful signs including the Smart Growth Network and the existence of courses such as those at Bond University in Sustainable Development. However the nature of the development process in a capitalist framework still cause concern for the quality of the process of development. The needs, desires and motivation of

stakeholders do not and cannot coincide in the development of new towns or the renewal or redevelopment of existing urban areas. This needs to be acknowledged and worked with in a mature manner with healthy accompanying vigorous debate. The start point for the design process is human needs, not minority interests or private profit. The notion of the common good needs to be paramount in planning decisions.

7.7 Areas for further research

The focus of this research paper was intended to be on urban connectivity (see figure 2.3). Urban connectivity is seen as key to urban design and making places work (Llewellyn Davies, 2007). The research conducted was limited in scope and only the factors of accessibility, barriers, destinations and proximity as they affect urban connectivity were covered in any detail. During the course of the research it was noted that the following aspects might require further research.

- Topographic and engineered barriers to urban connectivity in the case of Robina a study of the topography of the area and its effect on route choices specifically the difficulties of re engineering Robina Parkway. The effect of slopes on walkability and a method to include this in a ped shed analysis. The role of Queensland Department of Main Roads has not been pursued in this research project but questions about the role of the “Shaping Up” document arose during the case study (Queensland Government, 2008). It would appear that there is a breakdown between policy and practice for the engineers who designed the current road structures
- A study of urban design in Robina, with an emphasis on its contribution to the aesthetics, spatial layout and the creation of public spaces. Designing for density, and possible improvements to building codes for residential areas to encourage better more active and vibrant streetscape is considered an important step in any retrofitting of the residential areas.

- A study of the conditions of walking surfaces, climate and shade provisions on the paths and streets of Robina could contribute a context from which to consider a policy and program of improvement.
- A study into the opinions of the residents of Robina with special regard to unearthing their views on sustainability, community and their preferences for urban design and connectivity.
- A study of conditions in Robina covering street lighting, street surveillance, feelings of safety, and pedestrian vehicle conflicts. This should actively seek to survey residents for their opinions.
- A study of the mobility options and choices with a focus on pedestrian, cycling and public transport priority for the residents of Robina, and to find alternatives if car ownership is not possible in the future.
- A structured transport study to calculate the excess travel costs and increased carbon footprints of MPCs like Robina
- An investigation into the barriers created by planning schemes in producing optimal urban design outcomes and the creation of urban design guides for laymen and developers
- An investigation into the effects of the urban connectivity on the opportunity to participate in an active healthy lifestyle for those people who have barriers to that opportunity through ill health, age, disability or income

In conclusion the combination of the Integrated Planning Act, the SEQRP and the GCPs in tandem with the market urbanism evident in the development of Robina can be seen to be a failed method for sustainable development of new settlements. Change in the way urban development is financed, planned and realised is necessary to prevent a continuance of the same mistakes. It does not make sense to design inefficient, car dependent communities in the 21st Century, planning should start and end with the aim to benefit people and not just private companies. The current financial crises clearly demonstrate the need for public oversight and regulation for such an important area as sustainable development.

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